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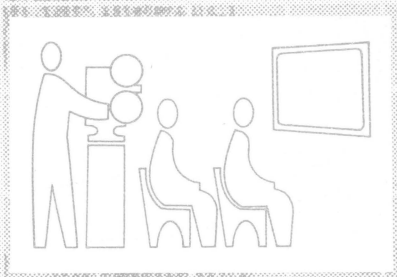
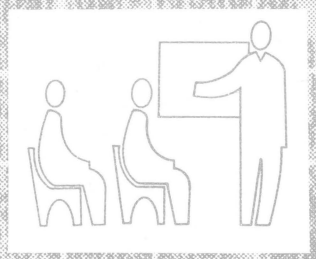
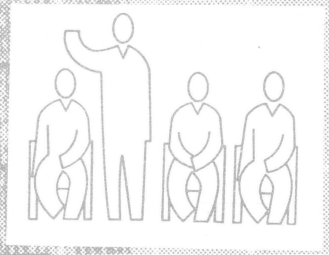
Characteristics of Agricultural Innovators And Other Adopter Categories

EVERETT M. ROGERS







OHIO AGRICULTURAL EXPERIMENT STATION

Wooster, Ohio

SUMMARY

Purpose of the present study was to determine the characteristics of innovators and other adopter categories. Data were obtained from a statewide random sample of 104 farm operators and from a state-wide sample of 99 innovators. Innovators are the first farmers to adopt new practices. Other adopter categories in order of relative time of adoption are early adopters, early majority, late majority, and laggards.

The major findings of the present study may be summarized as follows:

1. The personal characteristics of innovators indicate they have higher adoption leadership, more education, greater formal participation, higher social status, younger age, higher reading level, and better interview rapport than other adopter categories.

2. The innovator's farm enterprises are also much different than their neighbors. Innovators are more likely to own their farms, have larger farms, higher gross farm incomes, greater farm efficiency, and a more specialized farm operation.

3. Innovators have more direct contact with agricultural scientists, are more likely to read research literature, and read more farm magazines than other adopter categories. Early adopters have more contact with county Extension agents and Vocational Agriculture teachers than do innovators, but innovators are more likely to be well acquainted with their county agent.

4. Innovators become aware of new farm practices at an earlier relative date than the average farmer and require less time to pass from awareness to adoption of new practices. The present findings suggest that one of the most important reasons why innovators are the first to adopt is because they require a relatively shorter adoption

period.

5. Innovators tend to be more venturesome, more cosmopolitan, less likely to believe in agricultural magic, and more favorable toward the use of credit than the average farmer. While an innovator's neighbors often scoff at his use of new practices, the innovator is usually integrated into a friendship clique with other innovators who approve of the new practice.

6. The adopter categories rated themselves fairly accurately as to their adopter category; innovators had more accurate self-images than did laggards or other adopter categories. There was a general tendency for farm housewives to rate their husbands in an earlier adopter category than the one to which they belonged on more objective criteria.

The present data suggest that the agricultural innovator plays four major roles in the diffusion of new ideas: (1) a line of communication; (2) a local demonstrator; (3) an influencer of local change agents; and (4) a developer of new technology.

ACKNOWLEDGMENTS

Thanks are due to John Useem and Richard Adams of Michigan State University and John W. Bennett of the Ohio State University for their suggestions as to the study of innovative behavior. Ron L. Pitzer, formerly Research Assistant in Rural Sociology, aided in the analysis of the data. Appreciation is also expressed to the 44 county Extension agents in Ohio who aided in the selection of the agricultural innovators in the present study.

CHARACTERISTICS OF AGRICULTURAL INNOVATORS AND OTHER ADOPTER CATEGORIES*

by

Everett M. Rogers**

INTRODUCTION

New technological ideas in agriculture flow from research workers at state agricultural experiment stations and agricultural companies to farmers. This flow of new ideas is called the communication process. Agricultural scientists initiate the process and the farmer receives information and (perhaps) adopts new farm practices.

Intermediaries in the Communication Process

There are many "intermediaries" in this communication process between scientist and farmer. Various channels of communication diffuse information through the communication process. Mass media such as farm magazines, bulletins, and radio and TV farm programs play an important role. Employees of such government agencies as the Extension Service, the Soil Conservation Service, and Vocational Agriculture actively attempt to communicate new farm ideas and obtain their adoption. These professional agricultural workers are sometimes termed "change agents" because they seek to obtain the communication and adoption of changes by their "constituents" (the persons with whom they have a responsibility to work).

A farmer's neighbors, friends, and relatives are also important intermediaries in the diffusion of new farm practices. As one farmer

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*This bulletin reports findings from Ohio Agricultural Experiment Station Project Hatch 166, "The Communication Process and the Adoption of Farm and Home Practices."

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remarked in a research interview, "I usually hear about new farm ideas several years before I actually use them. I'm convinced that the new practices are good, but I guess you'd call me 'conservative.' I like to see them used on a neighbor's farm before I'll adopt them."

Most farmers generally refuse to adopt a new practice until it has been demonstrated on a neighbor's farm. Past research findings indicate that all farmers do not adopt a new practice at the same point in time. The earlier adopters tend to influence the decisions of the later adopters.

The Two-Step Flow of Communication

Past research has suggested a "two-step flow of communication" in which new ideas are first communicated and adopted by the earlier adopters who, in turn, convince the later adopters to use the new ideas. Since the two-step flow of communication was originally hypothesized in a study of the 1940 presidential election,[1] several improvements and modifications have been suggested. For example, research findings suggest that there may actually be a three-step or even a multi-step flow of communication. Nevertheless, the basic idea of a two-step flow of communication is utilized in the present study.

The earliest 2.5 percent of the farmers to adopt new farm practices are called "innovators." The next 13.5 percent are termed "early adopters." "Early majority" are the next 34 percent to adopt, and "late majority" are the next 34 percent. The last 16 percent of the farmers to adopt new farm practices are called "laggards." A detailed description of the method by which farmers are placed in

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[1]Paul F. Lazarsfeld and others, The People's Choice, N. Y., Columbia University Press, 1948, p. 151.

these "adopter categories" may be found in Appendix A.

The two-step flow hypothesis suggests that innovators and early adopters would be a crucial audience for the efforts of the change agent attempting to secure the adoption of new practices. Intensive efforts with these farmers may result in the indirect communication of new ideas to the total audience.

Purpose

A basic principle in propaganda efforts, public relations work, and advertising is to "know your audience." It would seem important for change agents, agricultural scientists, and farm leaders to know the characteristics of agricultural innovators and other adopter categories. Then, certain target audiences may be selected and certain communication methods may be chosen to reach them.

The purpose of this study is to determine the characteristics of innovators and other adopter categories. Special areas of investigation are personal characteristics, nature of the farm enterprise, communication behavior, adoption behavior, attitudes, and self-images. The long-range purpose of research on the communication of agricultural technology is to speed up the process by which new ideas are diffused from agricultural scientists to farmer-adopters.

HOW THE STUDY WAS DONE

The Commercial Farmer Sample

Data for the present study were obtained in personal interviews with a state-wide random sample of Ohio farm operators. In order to be eligible for inclusion in the sample, a farmer must have (1) farmed more than 20 acres, and (2) worked off the farm for pay

fewer than 100 days in 1956. This yielded a sample of 104 respondents who were essentially "commercial farmers." Each commercial farmer in the state had about one chance in 410 of inclusion in the sample. These respondents are referred to as the "commercial farmer sample" on this publication.[2]

The major dimension of analysis throughout this publication is on the basis of adopter categories. The 104 respondents were categorized as innovators. early adopters, early majority, late majority, and laggards on the basis of an Adoption-of-Farm-Practices Scale. This scale was composed of 25 recent farm practices that were suggested by Ohio Extension Service specialists. The criteria used in selecting these practices, the scoring system used in constructing the Adoption-of-Farm-Practices Scale, and the validity and reliability of this scale are discussed in Appendix A.

The Adoption-of-Farm Practices Scores measured the tendency for farmers to adopt new farm practices at a relatively early or late point in time. This adoption scale was used to categorize farmers into adopter categories. Respondents with the highest scores tend to be the first farmers (relative to other farmers in the sample) to adopt new practices; they are the innovators. A more detailed description of the method of adopter categorization is presented in Appendix A.

The Innovator Sample

This method of adopter categorization yielded only 3 innovators out of the total sample of 104 commercial farm operators.

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[2]A more adequate description of this sample may be found in Everett M. Rogers and Harold R. Capener, "The County Extension Agent and His Clientele," Wooster, Ohio Agricultural Experiment Station Research Bulletin, in progress.

This was too small a number of innovators to furnish accurate estimates of their personal characteristics. There was a need to "fatten up" the sample of innovators. Because of their relatively small numbers in the total population, it would have been necessary to interview 1,000 farmers to obtain as many as 25 innovators.

An alternative procedure was utilized, however, which yielded a total of 96 innovators out of a total of 146 farmers interrogated. This "short cut" was accomplished with little bias in the sampling procedure. In order to obtain the names and addresses of innovators, personal interviews were completed with a state-wide random sample of 44 of the 88 county Extension agents in Ohio in 1957.[3] These county agents were asked to provide the names and addresses of innovators in their county. The county Extension agents seemed able to answer this question easily; in a few minutes of interview time they were able to list the names of more than four innovators per county. Innovators were defined for the county Extension agents as "the first farmers in your county to adopt new farm practices." The county agents had been exposed to a training session on the role of agricultural innovators about a year before the interview and seemed to have a good idea who the innovators were in their counties.

The 150 innovators "nominated" by the 44 county Extension agents were sent a mailed questionnaire in 1957. Responses were received from 146, a response rate of 97 percent! This high rate of response to the mailed questionnaire indicates one important characteristic of innovators. They are "research-minded" and willing to cooperate in a research study.

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[3] A detailed description of the selection and interviewing of these 44 county Extension agents may be found in Everett M. Rogers and R. Dwayne Yost, "Communication Behavior of County Extension Agents," Wooster, Ohio Agricultural Experiment Station Research Bulletin, in progress.

As one portion of the mailed questionnaire, the nominated innovators were administered a shortened form of the 25-practice adoption scale. The adoption score limits for the innovator category had been established in the previous commercial farmer study already described. In order to qualify as an innovator, a farmer (nominated by his county agent) was required to score above 5.42 on the Adoption-of-Farm-Practice Scale. Out of the 146 nominated innovators, 50 failed to qualify as innovators and were discarded. The 96 remaining met the criteria and are included with the three innovators contained in the commercial farmer sample to form a total of 99. These are referred to in the remainder of this report as the "innovator sample."

It must be pointed out that there is a source of bias in the selection of these innovators. There are no farmers in the innovator sample who are not innovators (on the basis of their adoption scores). However, there may be many innovators in Ohio who were not included in the innovator sample because they were not nominated by their county Extension agent. The extent of this bias is difficult to estimate. However, there is reason to think it might not be serious.[4] County Extension agents might be expected to nominate innovators who were especially "Extension-minded." Responses to several questions on the mailed questionnaire, however, indicated that a great number of the innovators were rather critical of their county Extension agent and that many innovators were nominated who were not particularly Extension-minded. Because innovators are

[4]There is another possible source of bias in the selection of these innovators. Only the "successful" innovators were included in the present study, as the "unsuccessful" innovators (if such exist) may have passed out of farming. The location and interrogation of these unsuccessful innovators, however, poses sampling problems beyond the scope of the present study.

such highly "visible" persons (as will become apparent in later discussions of their characteristics), it is quite likely that county Extension agents would know the innovators in their county even though these farmers did not work closely with the Extension program.

PERSONAL CHARACTERISTICS

If the change agent is to beam certain communication messages at certain audiences within his total constituency, he must be able to recognize these audiences. Thus, it is important for him to know the personal characteristics of the adopter categories. These personal characteristics may also help the change agent determine which communication methods to utilize in order to reach a certain adopter category. For example, if most innovators are found to possess a college education while the average farmer has only an eighth grade education, the change agent may write his message at a higher level for the innovators.

Adoption Leadership

The "two-step flow of communication" model has already been discussed. This model states that influences stemming from the mass media first reach "opinion leaders" who then pass this information along to their friends and neighbors as personal influence. Opinion leaders are defined as those individuals to whom others turn for advice and information. As such, opinion leaders are often influential in approving or disapproving new ideas. Opinion leaders exist in the communication of new farm ideas. In the

present study, 63 percent of the respondents said there were one or more opinion leaders in their neighborhood. Twenty percent of the respondents named two or more opinion leaders from which they secured agricultural information.

In the case of the agricultural communication process, however, opinion leaders are referred to as "adoption leaders." As such, adoption leaders are one type of opinion leaders. Adoption leaders are those individuals to whom others turn for advice and information about new farm practices. An Adoption Leadership Scale was constructed and administered to the respondents as part of the personal interview.[5] This scale measured the degree to which each farmer was an adoption leader.[6]

The crucial question to be answered is: Which adopter category do other farmers look to most for advice and information about new farm ideas? It would probably not be the laggards. In order to function as an adoption leader, a farmer must learn about

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[5] The scale consisted of six items:

(1) During the past six months have you told anyone about some new farming practice?

(2) Compared with your circle of friends (a) are you more likely, or (b) are you less likely to be asked for advice about new farming practices?

(3) Thinking back to your last discussion about some new farm practice, were you (a) asked for your opinion of the new practice or (b) did you ask someone else?

(4) When you and your friends discuss new farm practices, what part do you play (a) mainly listen, or (b) try to convince them of your ideas?

(5) Which of these happens more often (a) you tell your neighbors about some new farm practice, or (b) they tell you about a new practice?

(6) Do you have the feeling that you are generally regarded by your neighbors and friends as a good source of advice about new farm practices?

[6] These six items yielded a split-half reliability of .703. A Guttman scale analysis yielded a coefficient of reproducibility of 91.4 percent which contributes some evidence that the scale measures a single dimension. Correlation of the Adoption Leadership Scores with a sociometric validity check was / .367.

new farm practices before his neighbors and friends. There is some evidence from previous research studies that innovators are often not respected by their neighbors because they adopt new practices much sooner than the average farmer. In a study of the innovators of irrigation in Ohio, it was found that many of the irrigators' neighbors regarded them with little respect for their farming methods.[7]

Sociologists have generally viewed leaders as the group members conforming most closely to group norms. Past research studies have generally found adoption leaders to be "just like their followers, only more so." Adoption leaders are relatively more loyal to group standards and values. For example, Marsh and Coleman[8] found that in Kentucky neighborhoods with a "progressive" orientation toward new farm practices, the adoption leaders were adopting new ideas much sooner than their neighbors. However, in neighborhoods with a low value on using new farm ideas, the adoption leaders adopted at about an average rate.

The amount of adoption leadership for each adopter category is shown in Figure 1. The two categories of innovators and early adopters were pooled, due to the small number of cases (only three) in the innovator category. The relationship between Adoption Leadership Scores and Adoption-of-Farm Practices Scores is significant at the one percent level of probability.[9] Earlier adopter categories have a greater degree of adoption leadership.

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[7] Everett M. Rogers and Ron L. Pitzer, "The Adoption of Irrigation in Ohio," Wooster, Ohio Agricultural Experiment Station Research Bulletin, in progress.

[8] C. Paul Marsh and A. Lee Coleman, "Farmers' Practice--Adoption Rates in Relation to Adoption Rates of "Leaders"," Rural Sociology, 19:180-181, 1954.

[9] The coefficient of correlation expressing this relationship (and each of the others in the remainder of this bulletin) may be found in Appendix B.

These data do not, however, provide evidence as to whether innovators or early adopters posses greater adoption leadership (because only three innovators were administered the Adoption Leadership Scale). A shortened and more specific version of the Adoption Leadership Scale was administered to both the commercial farmer sample and the innovator sample. Each respondent was asked whether he helped to convince his neighbors or friends to adopt six specific new farm practices (such as weed sprays, feeds, crop varieties, and farm equipment). There is evidence that farmers who convinced their neighbors to adopt these ideas possessed a greater degree of adoption leadership.[10]

The average number of practices each respondent convinced his neighbors and friends to adopt by adopter category is shown in Figure 2. These data indicate that innovators and early adopters possess the greatest degree of adoption leadership. The hypothesis that innovators have less adoption leadership than early adopters is not supported. This finding suggests that both innovators and early adopters may be key audiences for the change agent to reach with his communication efforts.

Education

Past research findings have generally indicated that the adopter categories adopting earliest have more years of formal education. The average number of years of education for each adopter category is shown in Figure 3.

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[10]The coefficient of correlation between the number of practices respondents convinced their peers to adopt and Adoption Leadership Scores is $r = .367$ which is significant at the one percent level.

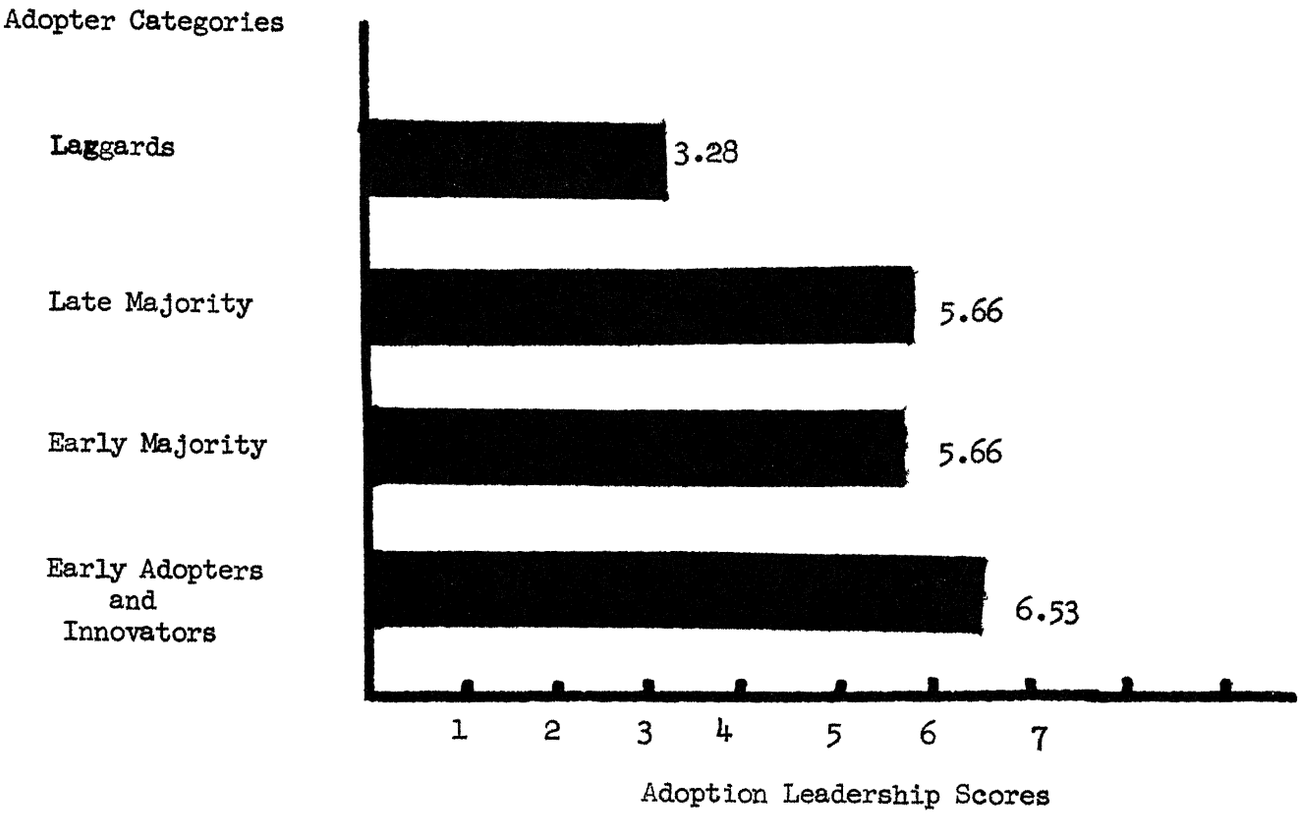

Figure 1. Adoption Leadership Scores by Adopter Category

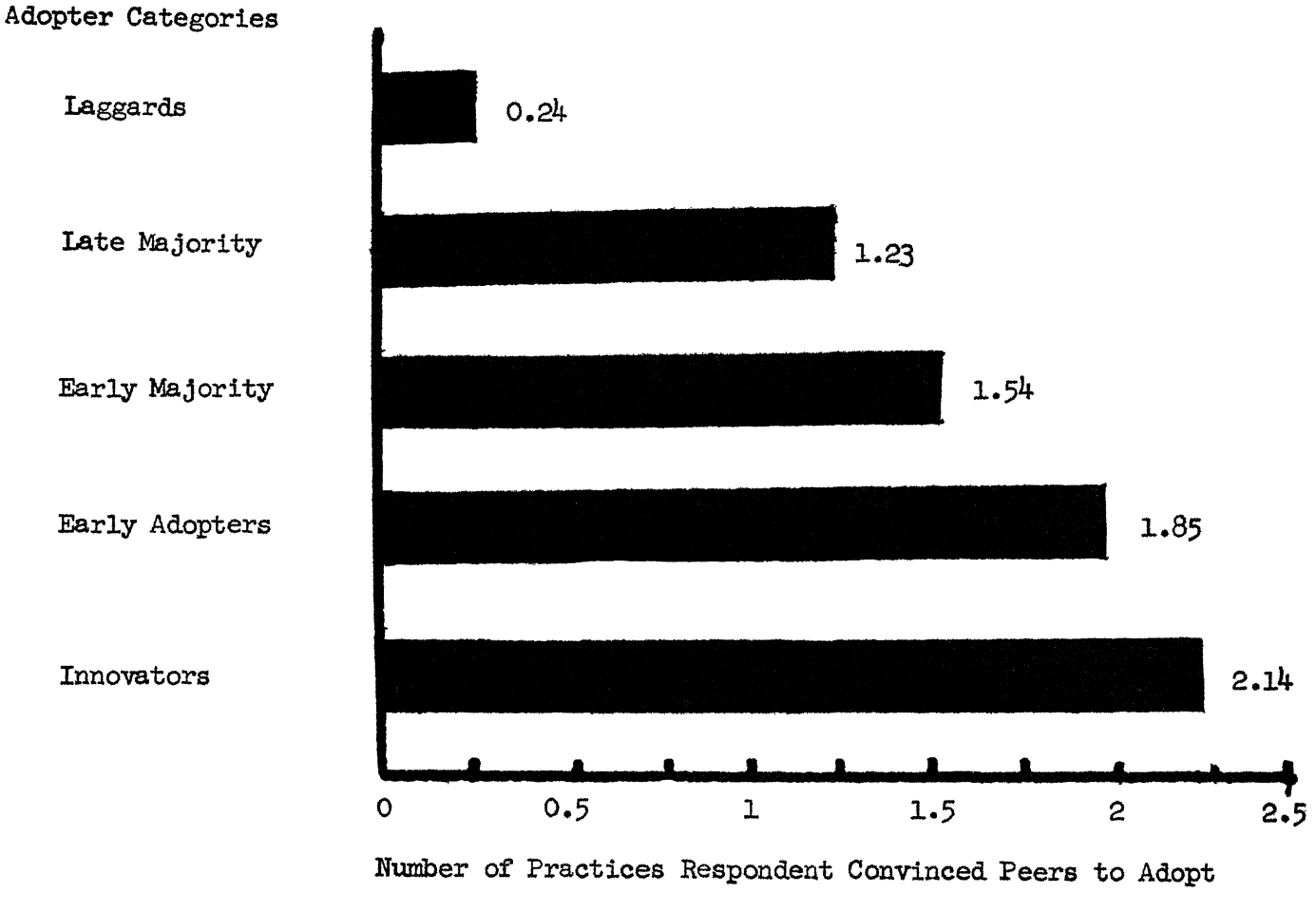

Figure 2. Number of Practices Respondent Convinced Peers to Adopt by Adopter Category

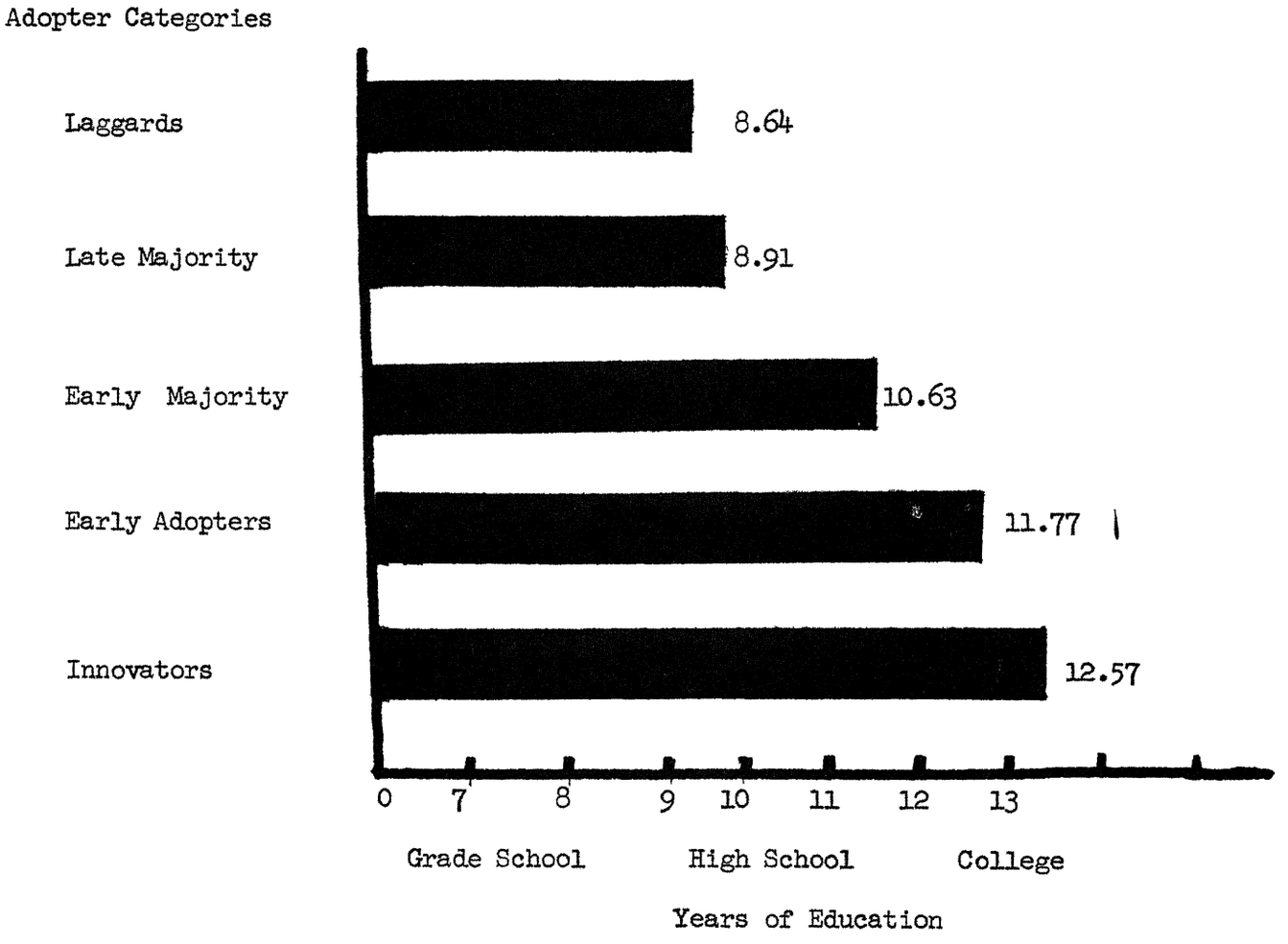

Figure 3. Years of Education by Adopter Category

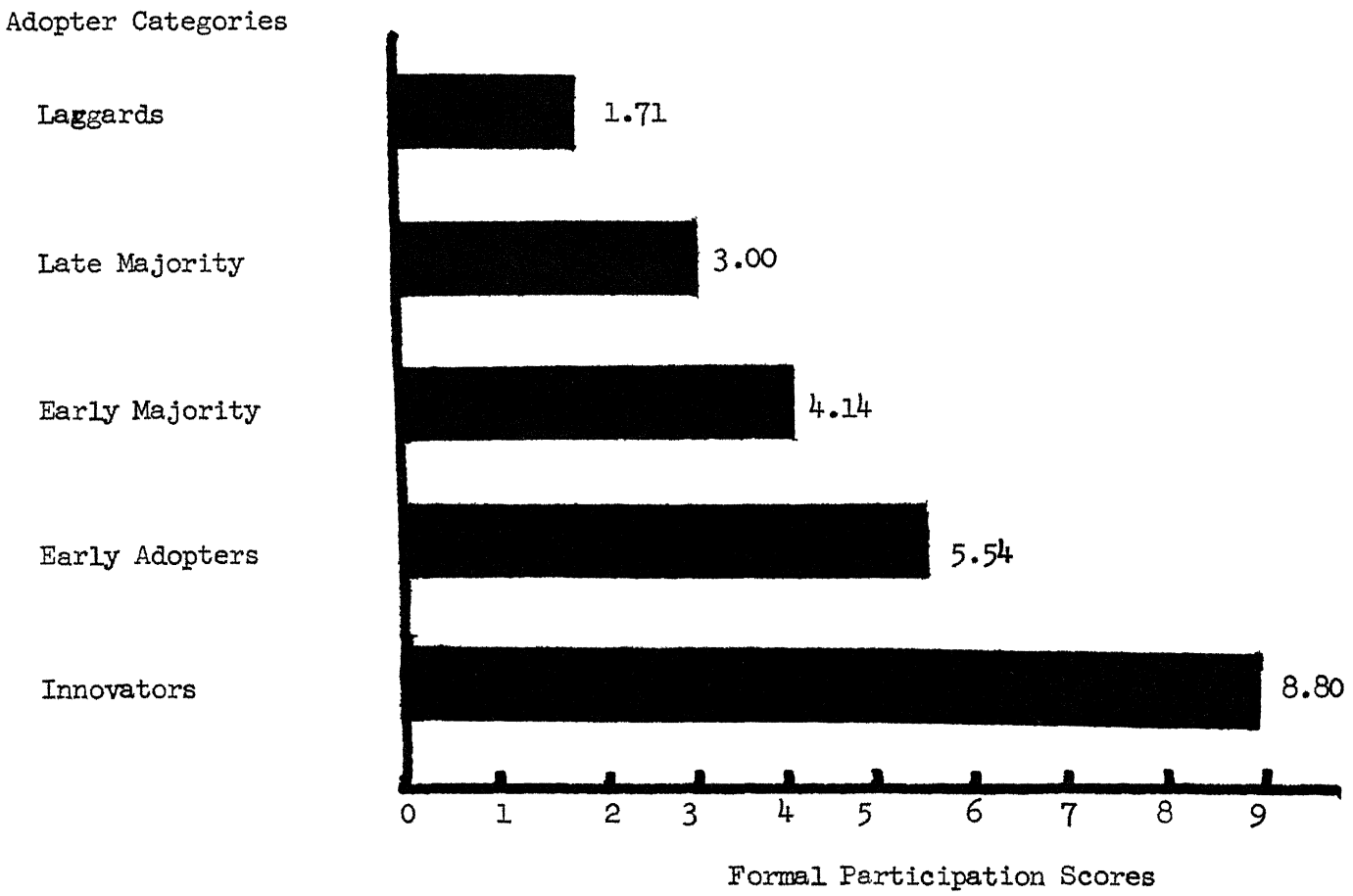

Figure 4. Formal Participation Scores by Adopter Category

Innovators averaged 12.57 years of formal education, or slightly more than a high school education. In contrast, the laggards averaged only slightly more than a grade school education. The relationship between Adoption-of-Farm-Practices Scores and years of formal education is significant at the one percent level.

Formal Participation

Past findings also suggest that farmers who are relatively early in adopting new practices are more active in such formal organizations as churches, farmer organizations, and PTA's. A Formal Participation Scale was constructed in the present study by asking farmers to what organizations they belonged and how active they were in each. One point was awarded for each membership in a formal organization and an additional point was awarded if the respondent was an "active member" or officer in the organization. Thus, the Formal Participation Scale measures the degree to which a respondent participates in formal organizations.

Figure 4 would suggest that the earlier adopting categories have consistently higher formal participation scores. The relationship is significant at the one percent level.

Social Class

At the conclusion of each of the 104 research interviews, the interviewer was asked to rate the respondent on a five-point social class scale from "high" to "low." These ratings were based on several objective criteria which sociologists have found closely related to social class position in America. Chief among these criteria which the interviewers used were education, income, wealth, and material possessions. In some cases where two interviewers

rated the same respondent, there was general agreement as to the social class rating.[11] This lends some evidence as to the objectivity of the social class rating.

Innovators and early adopters have higher social class ratings than do laggards (Figure 5). The relationship between social class ratings and Adoption-of-Farm-Practices Scores is significant at the one percent level.

Age

Past research findings have not been entirely consistent as to the relationship between age and adopter category. Most studies, however, have found that older farmers are less likely to be innovators and more likely to be laggards. This may partly be due to the growing conservatism often associated with advancing age.

Figure 6 shows that innovators and early adopters are more likely to be younger than other farmers. The relationship between age and Adoption-of-Farm-Practices Scores is significant at the one percent level.

Reading Level

Previous studies have found that innovators read more farm magazines and Extension bulletins than do laggards. One might expect that innovators have a higher level of reading skills. They also may have a higher level of intelligence, as measured by I. Q. scores.

The "cloze procedure" was utilized in an attempt to measure

[11] Herbert F. Lionberger in a 1950 study of social status rankings in a Missouri rural community found that interviewers' social class ratings (similar to those in the present study) correlated $r = .80$ with the composite social status ratings made by several community judges. This suggests that interviewers' ratings may be nearly as accurate as those of "experts" or judges.

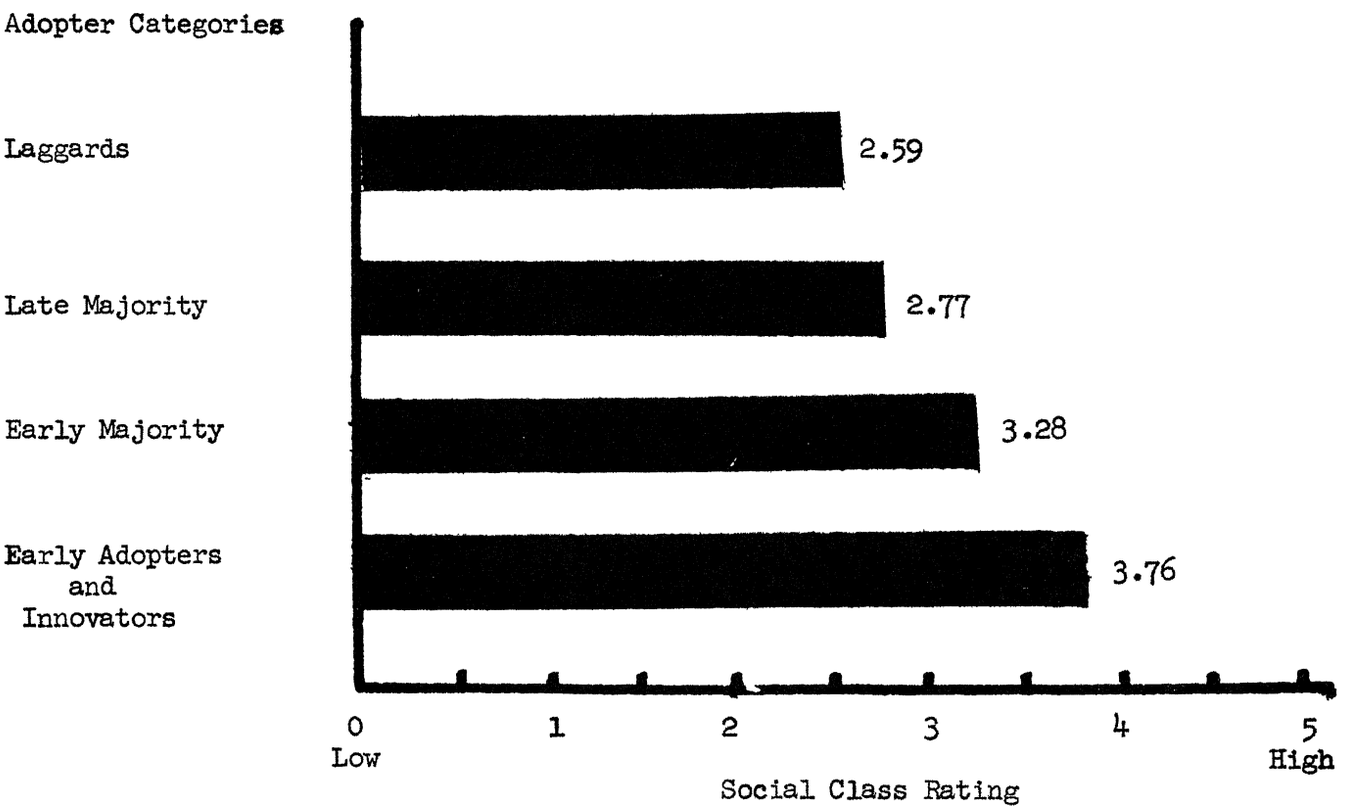

Figure 5. Social Class Position by Adopter Category

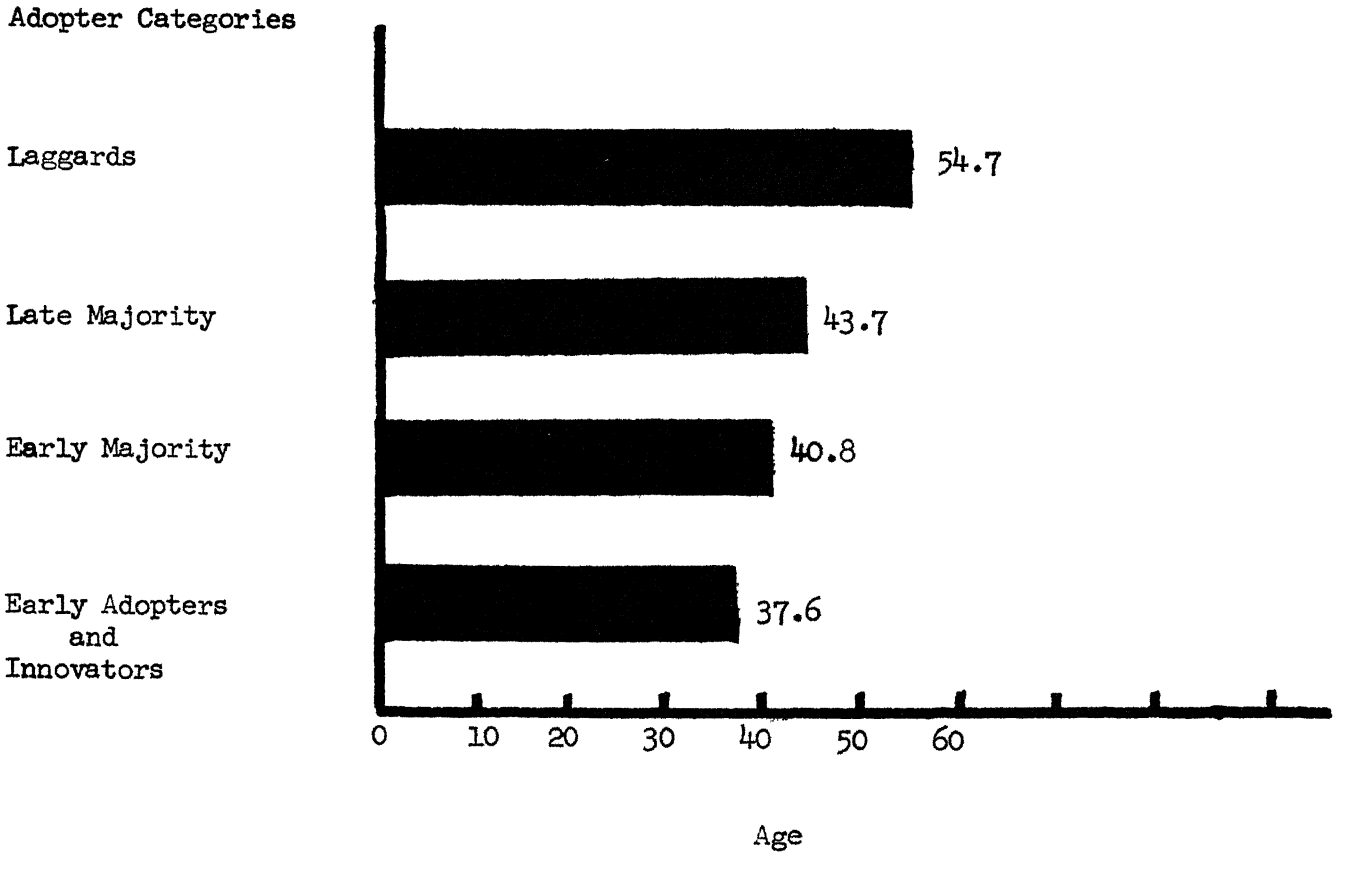

Figure 6. Age by Adopter Category

these dimensions. Taylor[12] originally developed the cloze procedure as a measure of readability. In the present usage, three 100-word sections of manuscript were chosen from a farm magazine, an Extension bulletin, and a research report. Every fifth word was deleted from the 300-word passage and the deleted words were replaced with standard 10-space blanks.[13] A sub-sample of 22 respondents was asked to "cloze the gaps" by filling in the missing words. Each respondent's cloze score was the number of blanks (out of the 60 possible) that he could correctly fill in.

The present findings (Figure 7) indicate that while the first three adopter categories are generally similar in reading level, the late majority and laggards are far below the innovators, early adopters, and early majority. It must be pointed out that these findings are very tentative; they are only based on data from 22 respondents. The relationship between Adoption-of-Farm-Practices Scores and cloze scores is not significant at the 5 percent level.

Taylor's recent findings indicate that cloze scores not only measure differences in readability between different manuscripts but also measure individual differences in reading ability.[14] Taylor stated, "The technique appears to be an effective gauge of 'individual differences' in the comprehension of readers, and of success in learning, general intelligence, and specific technical

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[12]Wilson L. Taylor, "'Cloze Procedure': A New Tool for Measuring Readability," Journalism Quarterly, 30: 415-433, 1953.

[13]The present experience suggests that deletion of every fifth word leaves a passage that is too difficult for the average farmer to complete in a field interview. Deleting about every tenth word would be more appropriate.

[14]Wilson L. Taylor, "Recent Developments in the Use of 'Close Procedure'," Journalism Quarterly, 33: 42-48, 1956.

knowledge." Taylor found a very high relationship between cloze scores, I. Q. scores, and an index of technical knowledge.

The findings suggest that innovators, early adopters and early majority may excel in intelligence as well as in reading ability. This would seem reasonable, as the first adopter categories must be able to secure much of their new farm information from mass media (mostly printed) sources while late majority and laggards depend more on personal influence from their neighbors who have already adopted the new practice. The adoption decision for an innovator requires a different type of mental skill than it does for a laggard.

Interview Rapport

At the conclusion of each research interview, the interviewer rated the respondent as to interview rapport on a four-point rating scale from "very poor rapport" to "very good rapport."

All of the innovators were rated as "very good rapport." There was a consistent decrease in average interview rapport from innovators to laggards. More of the interviews with laggards than with any other adopter category were rated as "very poor rapport." The relationship between interview rapport ratings and Adoption-of-Farm-Practices Scores is significant at the one percent level.

This finding suggests that there may be a built-in bias in the interviews with the later adopting categories. The poorer rapport with laggards may be due to educational and social class differences between the interviewers and the respondents; it may also be due to the laggards' lack of appreciation and understanding of research interviewing. A senseof shame from not having adopted

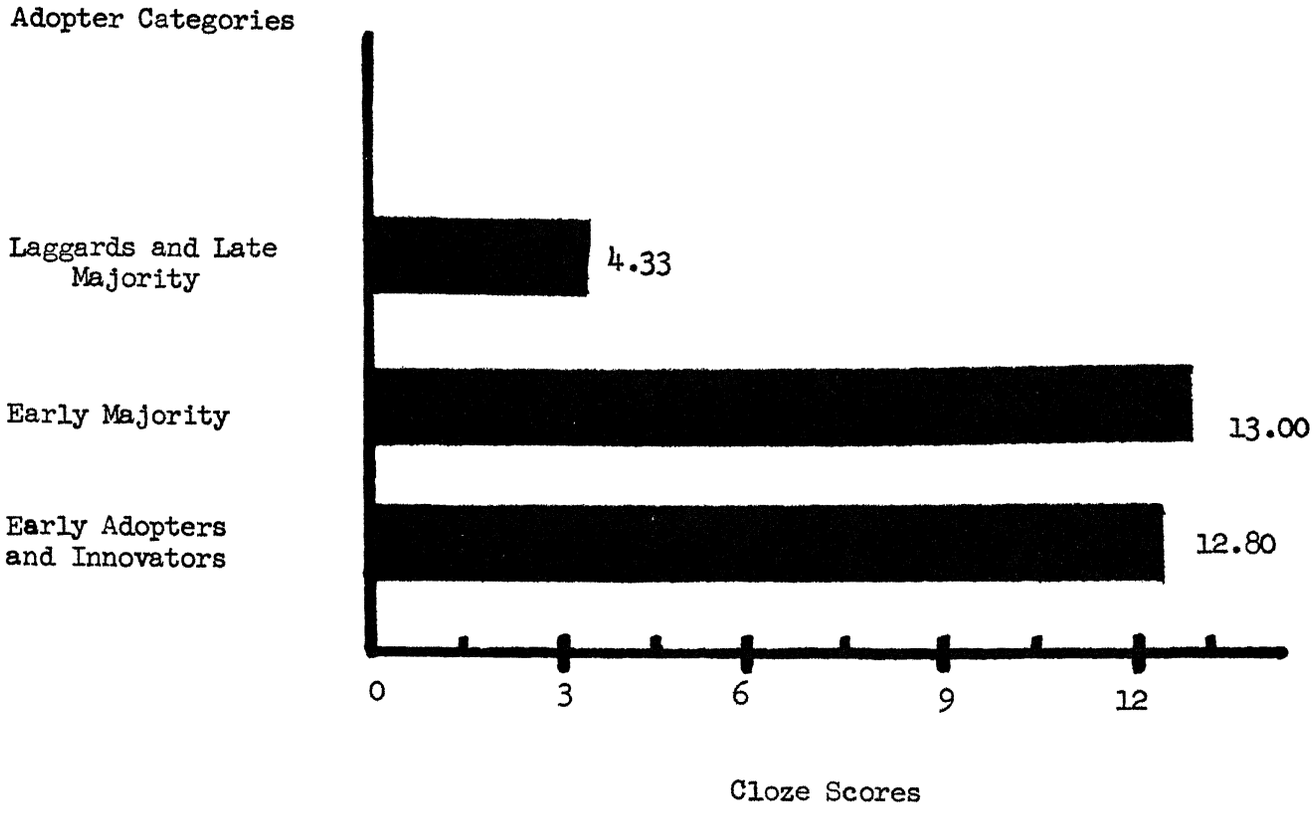

Figure 7. Cloze Reading Scores by Adopter Category

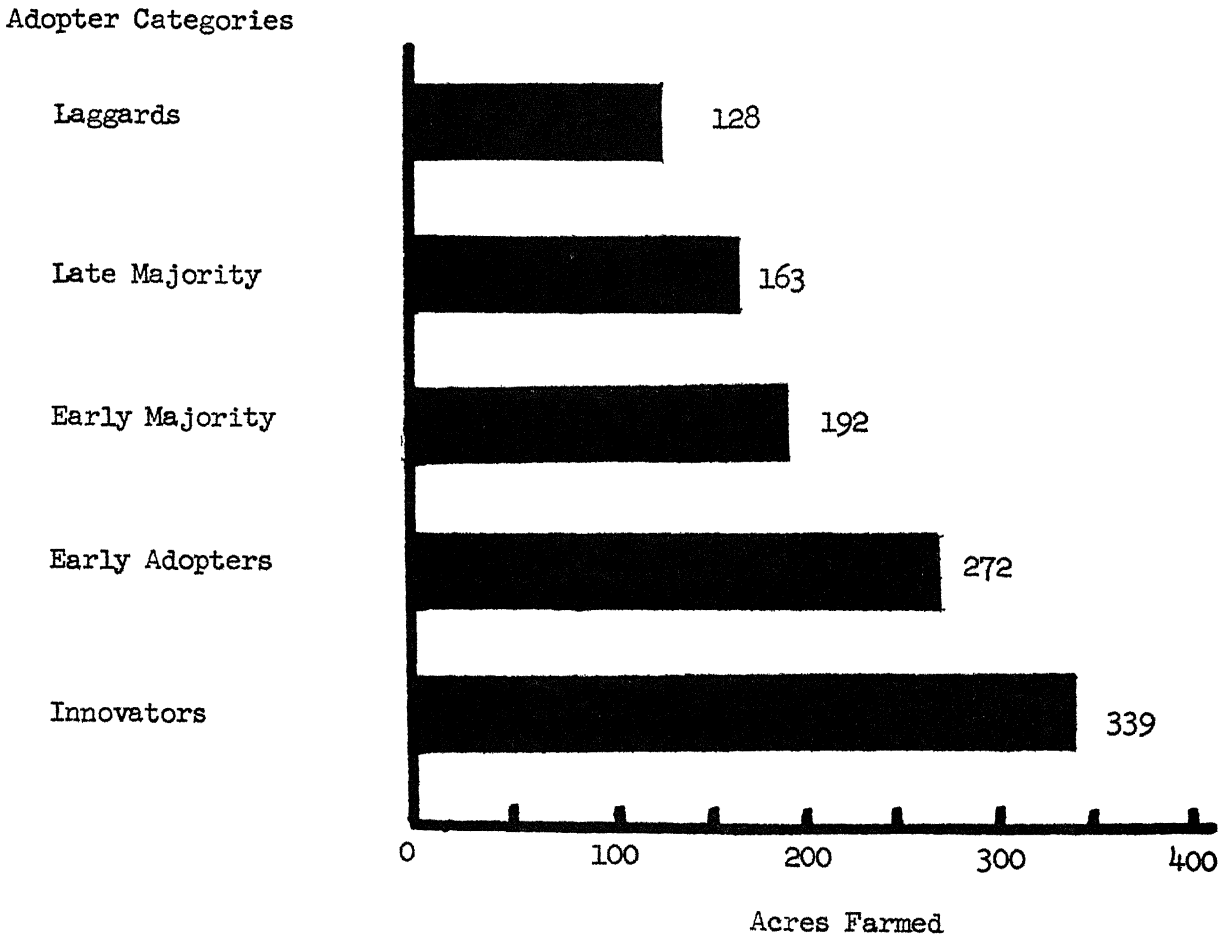

Figure 8. Acres Farmed by Adopter Category

new practices may be another reason for poor interview rapport on the part of laggards.

NATURE OF THE FARM ENTERPRISE

Just as adopter categories differ on personal characteristics and communication behavior, so might they be expected to differ in the nature of their farm enterprises. The size of the farm enterprise, economic returns, efficiency, and degree of specialization will be reported in this section for each adopter category.

Rental Status

When categorized on the basis of rental status, the innovators were much more likely to own all of the land they operated; laggards were much more likely to rent all of their land (nevertheless, almost 8 percent of the innovators rented all of their land and 12 percent of the laggards were full owners). Many of the innovators and early adopters rented part of the land they operated and owned part of it. Many of these farmers indicated they owned one farm and were renting other land from farmers who had retired or otherwise had left farming. Differences in rental status on the basis of adopter category were not significant at the one percent level. Renters seemed to be less free to adopt new ideas; they must often secure the approval of their landlords who tend to be more conservative.

Size of Farm Operation

The innovators operated the largest farms in acreage and the laggards operated the smallest farms (Figure 8). Innovators farmed an average of 339 acres while laggards farmed 128 acres.[15]

[15] The number of acres owned by adopter category followed a generally similar distribution to that of acres operated.

This means that although innovators only constitute 2.5 percent of the farm population, they operate about 4.6 percent of the farm land in Ohio. On the other hand, the laggards constitute 16 percent of the farm population, but they operate only about 11 percent of the farm land in Ohio. The relationship between Adoption-of-Farm-Practices Scores and acres operated is significant at the one percent level.

Another measure of size of farm in productive man work units (PMWU). A PMWU is the amount of work performed in a 10-hour day by an average worker with typical methods and equipment. PMWU's are probably a more accurate measure of farm size than are acres because they reflect the scope of both crop and livestock enterprises. For example, a farmer raising 100 thousand broilers on a 1-acre plot probably has a larger sized operation than a cash-grain farmer on 80 acres. The innovators had the largest sized farms in PMWU's while the laggards had the smallest (Figure 9). The relationship between Adoption-of-Farm-Practices Scores and the number of PMWU's is significant at the one percent level.[16]

Gross Farm Income

The innovators and early adopters not only operated larger sized farms, but also had a higher gross farm income (for 1956, the year preceding the interview). The innovators and early adopters averaged a gross farm income of $15,940 while the laggards averaged $4,200 (Figure 10). The relationship between Adoption-of-Farm-Practices Scores and gross farm incomes is significant at the one percent level.

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[16]The relationship between PMWU's and Adoption-of-Farm-Practices Scores (correlation is $\neq .456$) is significantly higher than the relationship between size of farm in acres and Adoption Scores (correlation is $\neq .264$).

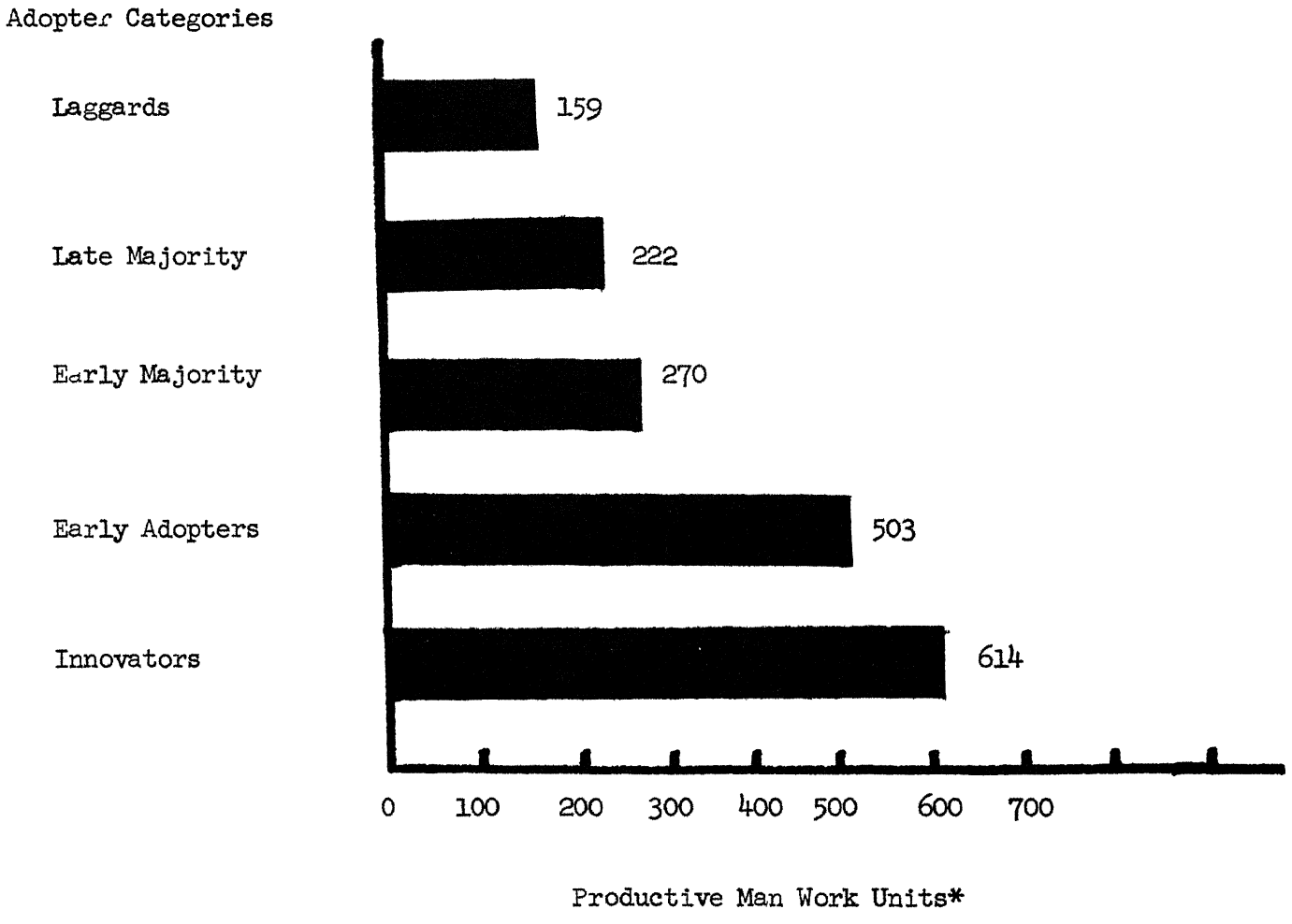

Figure 9. Productive Man Work Units by Adopter Category

*A productive man work (PMWU) is the amount of work performed in a ten-hour day by an average worker with typical methods and equipment.

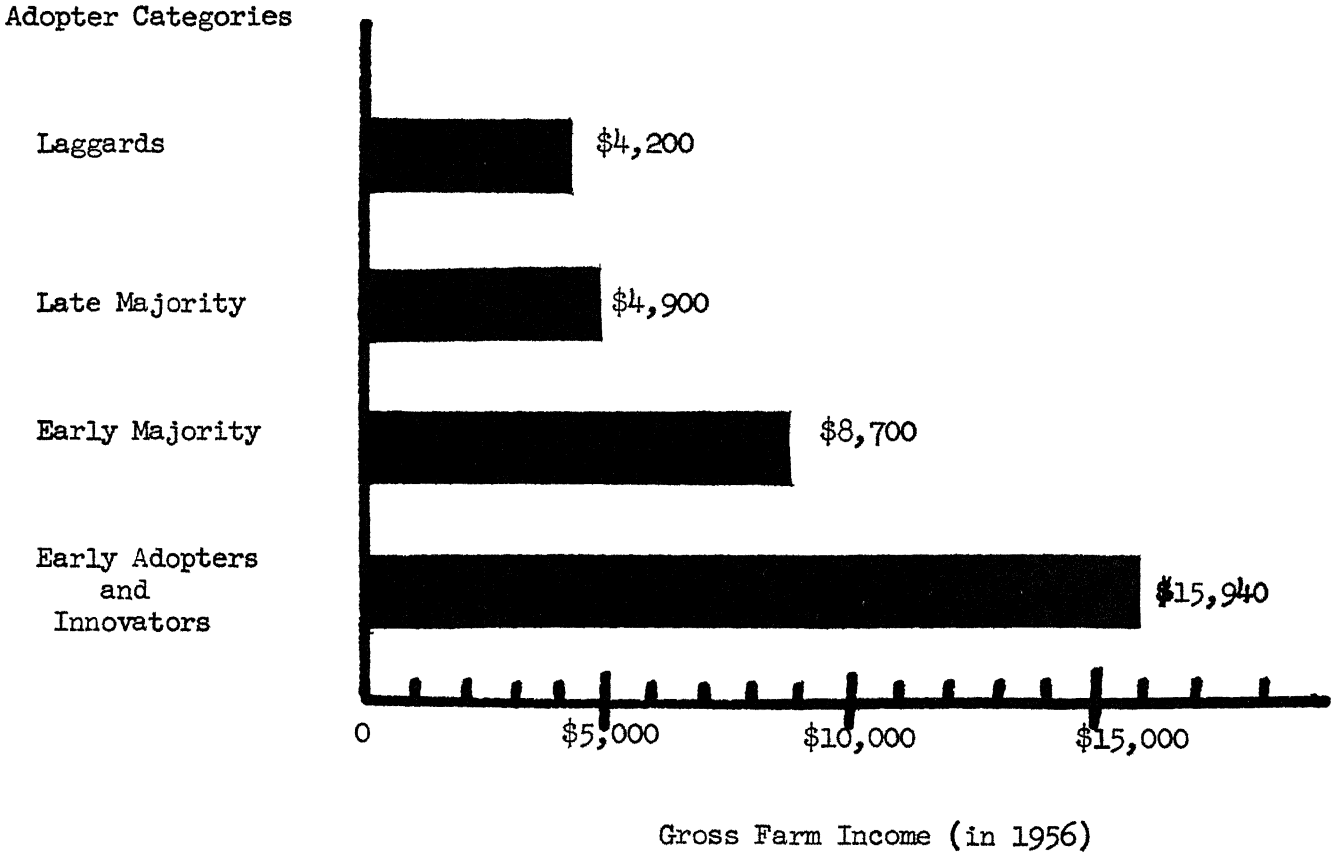

Figure 10. Gross Farm Income by Adopter Category

Farm Efficiency

There are several possible indexes that may be utilized to measure farm efficiency. Efficiency is defined as the ratio of returns to inputs in a system. One measure of farm efficiency is the ratio of gross farm income (return) to man days of labor (labor input). The innovators and early adopters averaged a gross farm income of $34.94 per man day of labor during 1956 while the laggards averaged $16.81. The relationship between Adoption-of-Farm-Practices Scores and gross farm incomes per man day of labor is significant at the one percent level.

Another measure of farm efficiency was also secured from the respondents in the commercial farmer sample. This measure of labor efficiency was computed as the ratio of productive man work units to the number of man days of labor actually expended in 1956, times 100. For example, if a farm operation was 300 PMWU's in size (a PMWU is computed on the basis of average efficiency), but the operator actually expended 400 man days of labor on this farm in 1956, then he farm labor efficiency ratic is (300/400) X 100 or 75. Thus, it is possible for this ratio to range from zero to over 100. The ratio, in effect, compares each farmer's input of labor with average labor efficiency (the PMWU).

The innovators and early adopters had a higher farm labor efficiency than did the laggards (Figure 11). The relationship between Adoption-of-Farm-Practices Scores and farm labor efficiency is significant at the one percent level.

Specialization

A farm operation is said to be specialized when one enterprise such as hogs, corn, or beef makes up a large share of the

total operation. A measure of specialization was available in the present study. This index of specialization was computed as the ratio of PMWU's in the major farm enterprise to the total number of PMWU's in the farm operation, times 100. Thus, a farmer with 300 PMWU's in his feeder cattle enterprise and 500 in his total farm operation would have a specialization ratio of 60. This indicates that 60 percent of his farm labor requirements are made up by one enterprise. This crude measure of specialization may range from zero to 100 and is independent of size of operation; that is, a small operation may be just as specialized as a large one.

The innovators and early adopters were more specialized than the laggards (Figure 12). The relationship between Adoption-of-Farm-Practices Scores and the index of specialization is significant at the one percent level.

COMMUNICATION BEHAVIOR

The purpose of this section is to investigate the communication behavior of the various adopter categories. The change agent will need to understand which communication methods reach each adopter category if he wishes to beam certain messages at these audiences.

Sources of Agricultural Research

A farmer's perception of the source of the agricultural communication process is one aspect of his communication behavior. Each of the respondents was asked where he thought research was performed to develop new farm practices. The most common answer was in terms of the state agricultural experiment stations, commercial concerns, and state agricultural colleges.

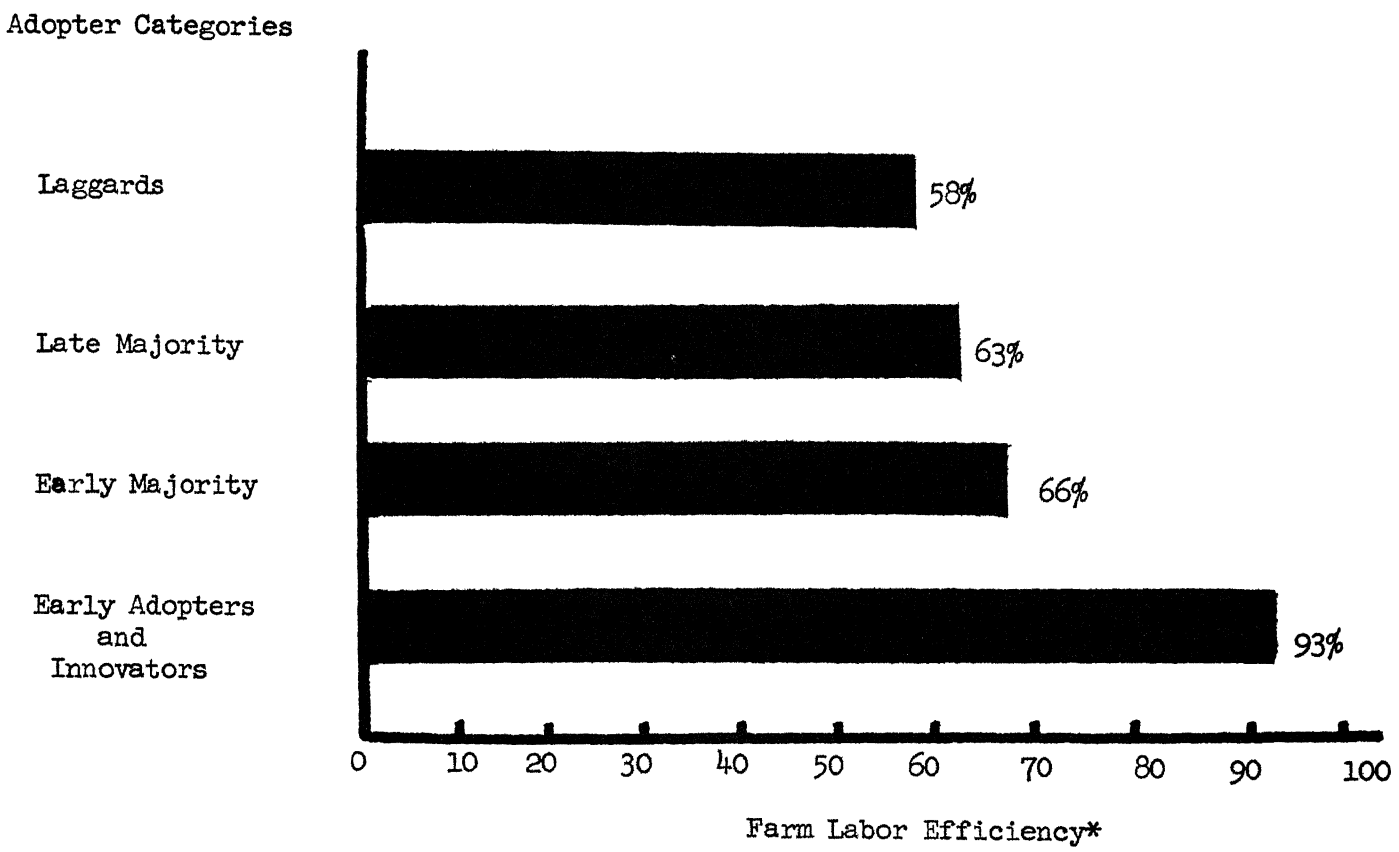

Figure 11. Farm Labor Efficiency by Adopter Category

*Farm labor efficiency is computed as the ratio of productive man work units to number of man days of labor actually expended in 1956, times 100.

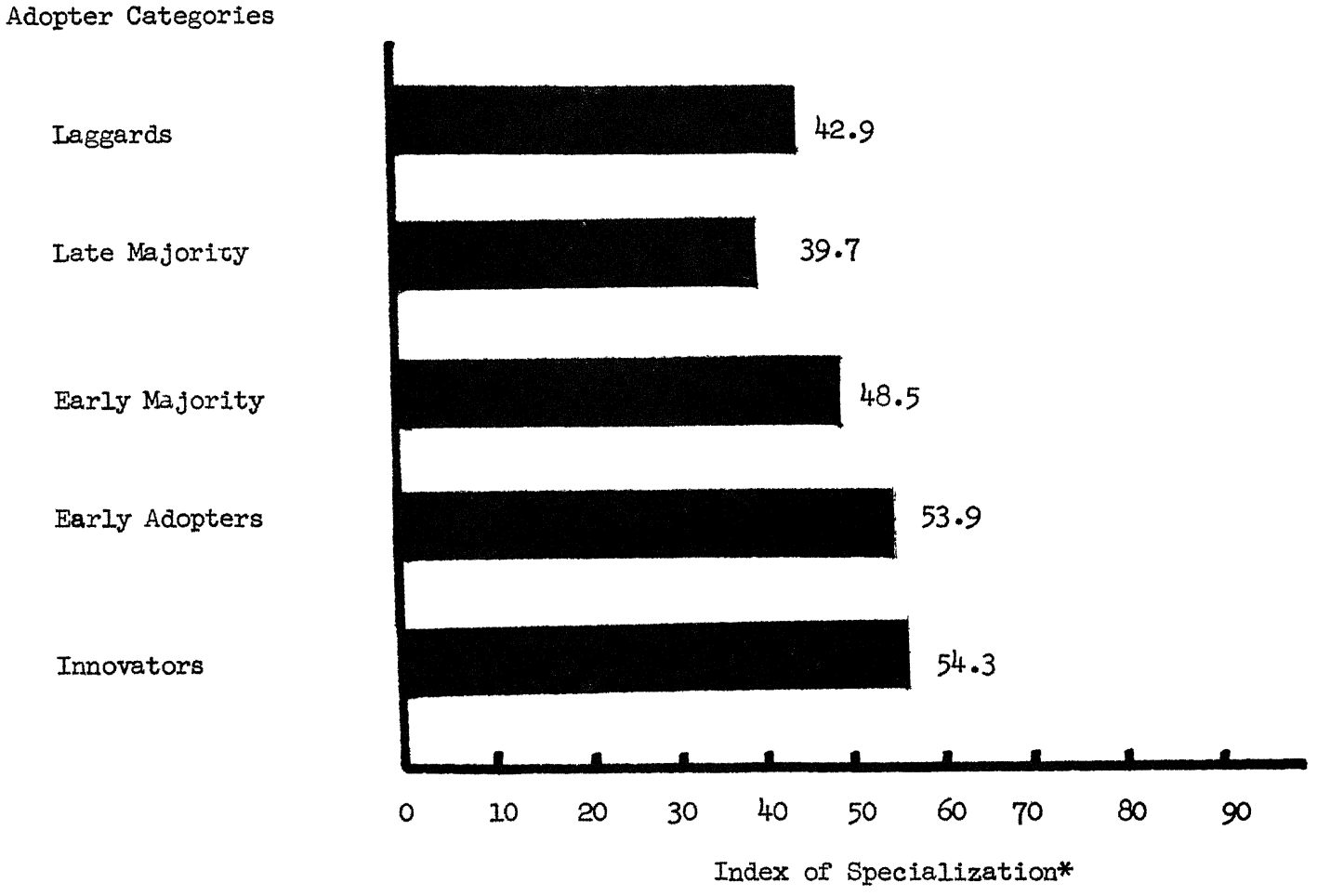

Figure 12. Degree of Farm Specialization by Adopter Category

*The index of specialization is computed as the ratio of PMWU's in the major farm enterprise to the total number of PMWU's in the total farm operation, times 100.

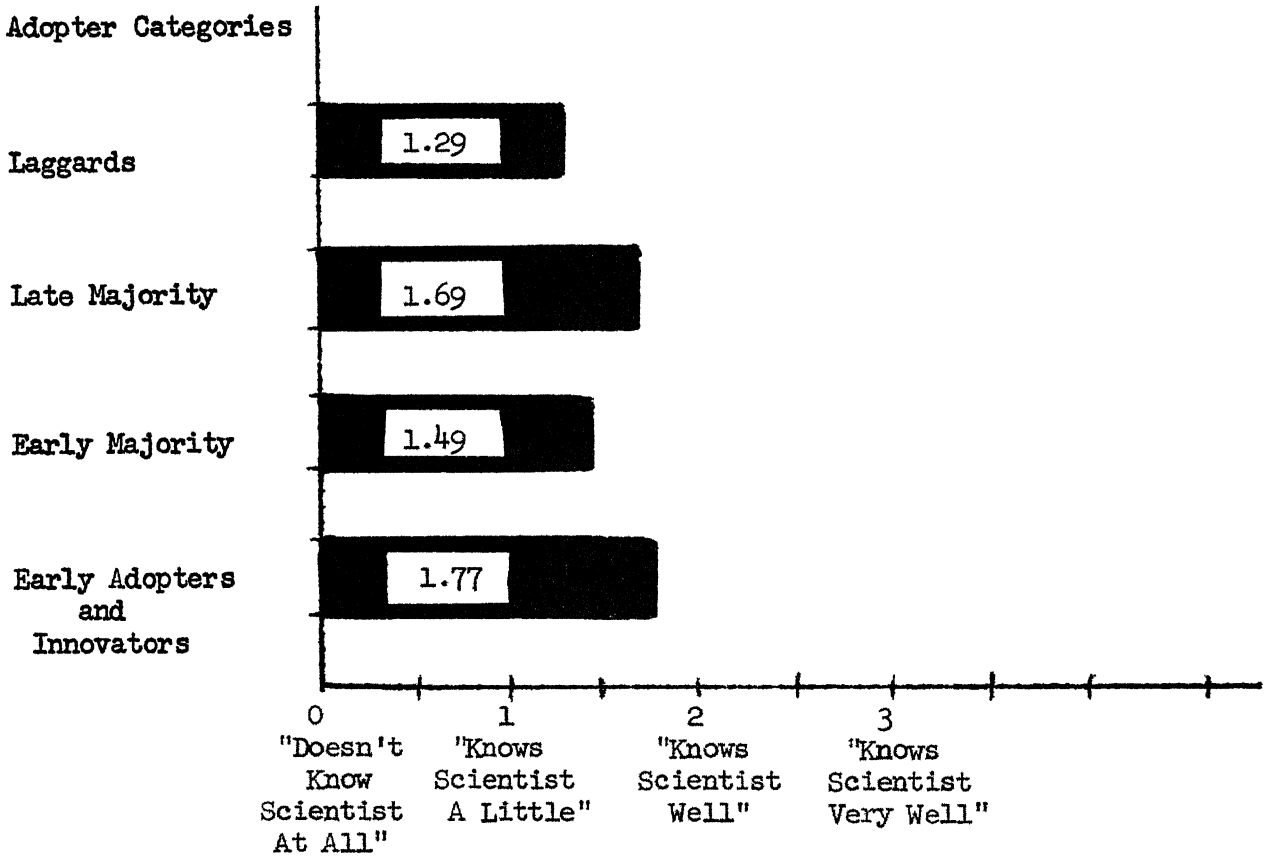

Figure 13. Psychological Closeness to Agricultural Scientist by Adopter Category

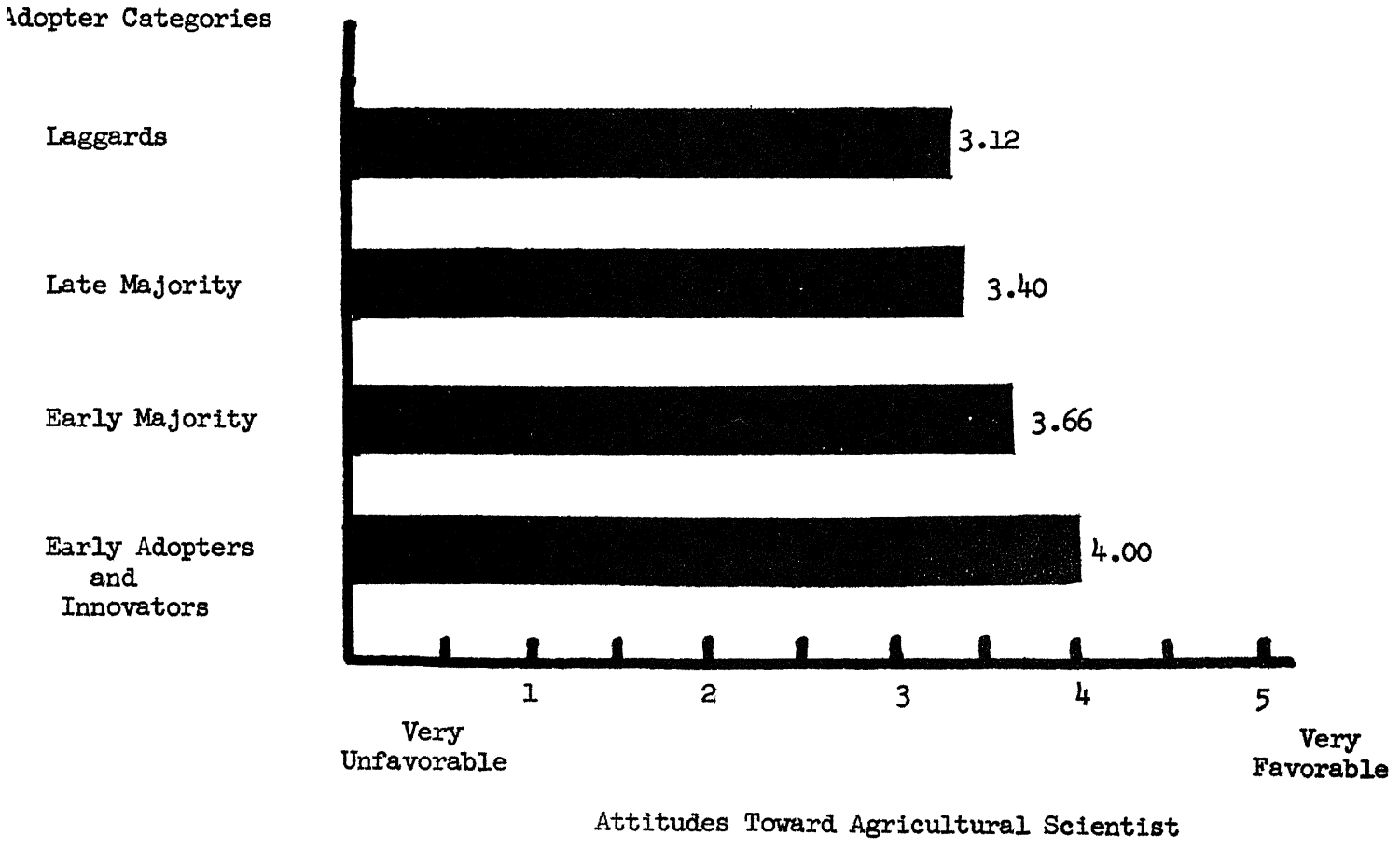

Figure 14. Attitude Toward Agricultural Scientist by Adopter Category

An analysis indicated few differences on the basis of adopter category. The innovators (especially) and the early adopters were more likely to mention the state Agricultural Experiment Station than they were commercial concerns. Laggards were most likely to name "farmers themselves" or else not to know where new farm practices were developed. As one farmer remarked, "I just don't rightly know. The new ideas come from some place, I guess." About 20 percent of the respondents did not know the source of new farm practices.

Contact With Agricultural Scientists

Some farmers have direct contact with agricultural scientists. This is probably one of the earliest and most accurate sources of new farm information. Past research findings indicate that innovators are more likely to have direct contact with agricultural scientists than are other farmers.[17]

As one means of investigating the respondents' contact with agricultural scientists, they were questioned about a Scientist Stimulus Picture (Figure 13). As the respondents answered questions about "the farmer in the picture," they were really providing information about their own behavior and attitudes.

The 104 respondents were asked how well they thought the farmer in the stimulus picture would know the scientist. Responses were categorized on a four-point rating scale from "not at all" to "know him very well." The innovators and early adopters were slightly more likely to feel the farmer in the picture would know the scientist

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[17]Everett M. Rogers and George M. Beal, "Reference Group Influences in the Adoption of Agricultural Technology," Ames, Iowa Agricultural Experiment Station Mimeo Bulletin, 1958; and James H. Copp, "Personal and Social Factors Associated with the Adoption of Recommended Farm Practices Among Kansas Cattlemen," Manhattan, Kansas Agricultural Experiment Station Technical Bulletin 83, 1956.

very well. This indicates a feeling of greater "psychological closeness" between these farmers and agricultural scientists. Laggards are more likely to view the scientist as a distinct referent. The relationship between Adoption-of-Farm Practices Scores and "psychological distance" ratings from the scientist is not significant at the five percent level.

The respondents were also asked how they thought the farmer in the picture felt toward the scientist. The replies were categorized on a five-point rating scale on the basis of favorableness of attitude toward the scientist. The innovators and early adopters generally tended to have more favorable attitudes toward agricultural scientists than did the other categories (Figure 14). However, the relationship between Adoption-of-Farm-Practices Scores and the attitude rating was not significant at the five percent level.

The respondents were asked whether they had traveled directly to the Ohio Agricultural Experiment Station or The Ohio State University to contact agricultural scientists within the year preceding the interview. Only about 10 percent of the commercial farm operators reported direct contact with agricultural scientists. Innovators were much more likely to have direct contact than any other adopter category (Figure 15). The difference is significant at the one percent level.

The respondents listed a variety of reasons for visiting with scientists at the University or Experiment Station. Many attended a field day or tour in order to seek the solution to some farm problem or to gain further information about some new practice.

> "I attended Farm and Home Week to learn about new silage equipment."

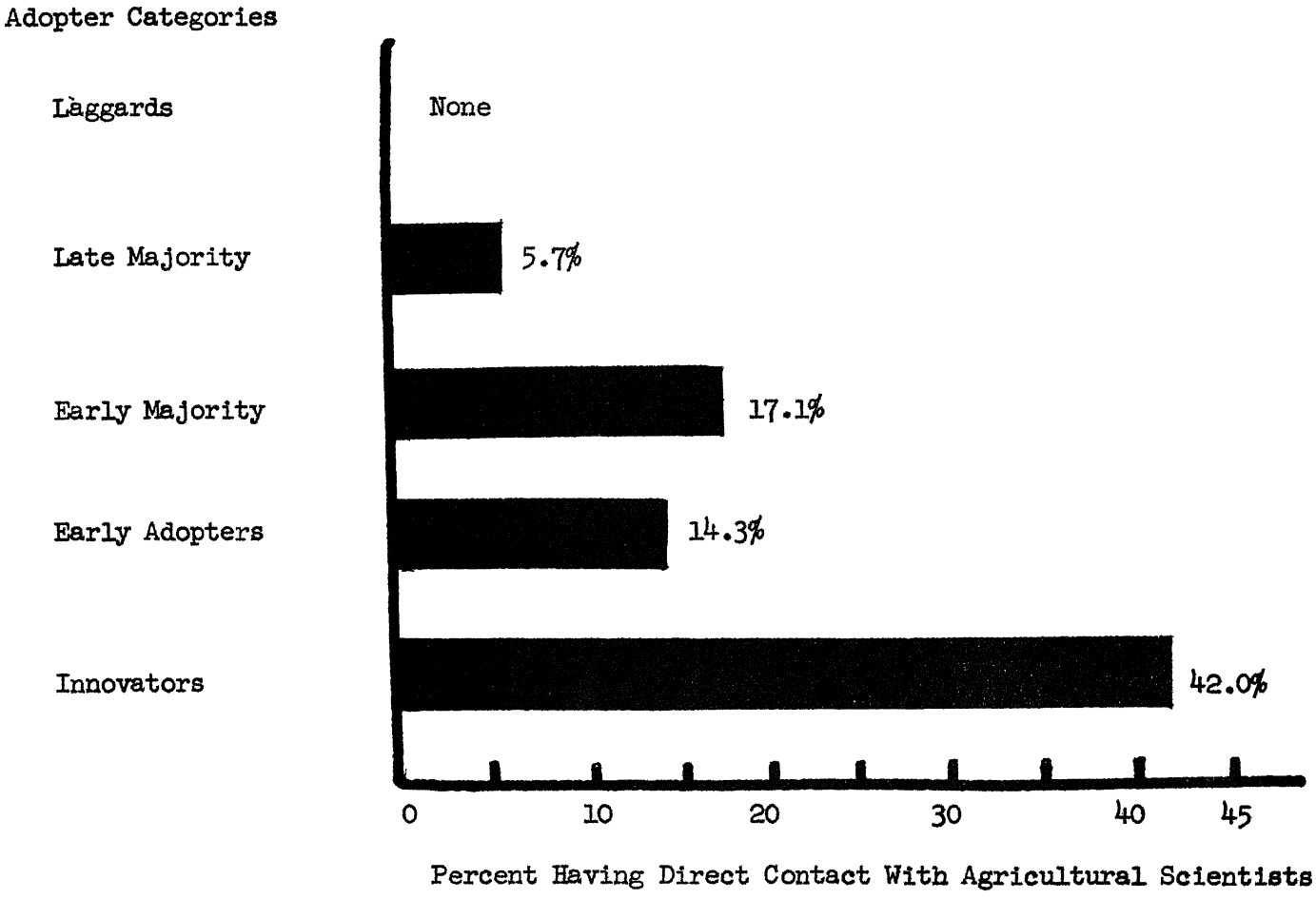

Figure 15. Percent Having Direct Contact With Agricultural Scientists by Adopter Category

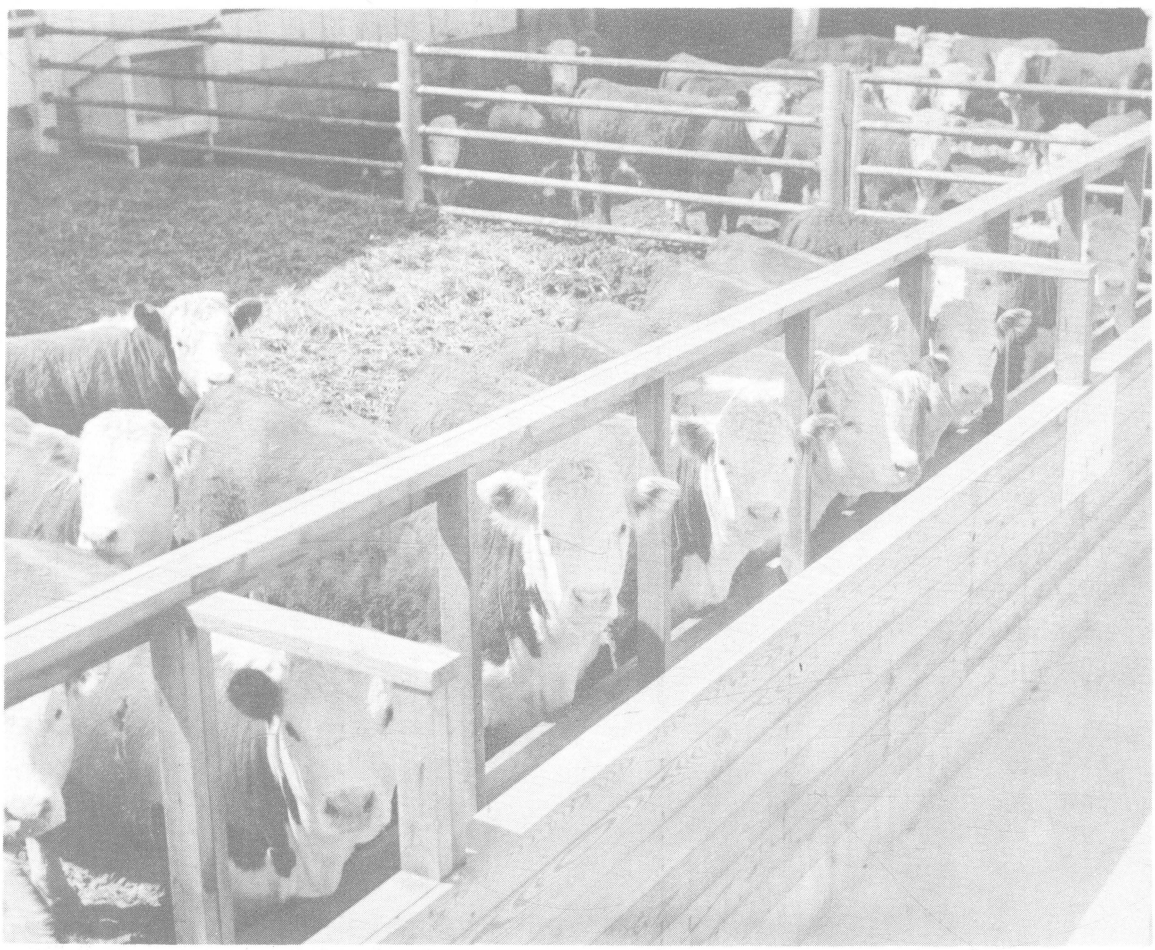

Figure 16. Innovators Are More Research-Oriented Than Other Adopter Categories

Innovators are interested in experiments and research studies such as this one under way at the Ohio Agricultural Experiment Station.

"My problems on livestock disease readication were answered at Dairy Day."

Other farmers indicated they made a special trip to visit with agricultural experts.

"I drove down to see Dr. Blank about some insect control ideas."

"I had questions on hay driers; the agricultural engineers consulted with me."

It might be expected that innovators would also be more likely to be personally acquainted with agricultural scientists at The Ohio State University and the Ohio Agricultural Experiment Station. Figure 17 shows that this is so. Innovators were not only more likely to know them "personally" rather than "by name only." The relationship between Adoption-of-Farm-Practices Scores and degree of acquaintance with agricultural scientists is significant at the one percent level.

Another way in which farmers may learn of the scientists' research findings is to read Ohio Farm and Home Research. This bi-monthly magazine carries articles by agricultural scientists on current research findings. The publication is free upon request. The greater "research-mindedness" of innovators would suggest that they would be more likely to subscribe to Ohio Farm and Home Research.

Figure 18 shows that this is so. Differences in percent subscribing to the publication are significant at the one percent level. Innovators are more likely than other adopter categories to receive research findings from agricultural scientists via Ohio Farm and Home Research.

Sources of Information

The sources from which each adopter category secures new

farm information has obvious importance for the change agent. For example, if innovators depend mainly upon Extension Service bulletins, then change agents may wish to utilize this method of communicating with this audience.

The respondents were queried as to their most important source of information about new farm practices. For the total sample, the most important sources (in order of importance) are farm magazines, friends, county Extension agents, and Extension Service bulletins. There were few major differences on the basis of adopter category. That is, one category did not depend exclusively on one source while another category depended almost entirely on a different source.

In general, however, there was a tendency for innovators and early adopters to utilize county Extension agents more than laggards. Friends and neighbors were more likely to be used by late majority and laggards. Farm magazines were slightly more important for innovators, but were quite important for all adopter categories. Extension Service bulletins and direct contact with agricultural scientists were especially important to innovators. These findings are somewhat consistent with those of past research studies.[18] Innovators and early adopters depended less on personal sources of information (especially from neighbors and friends) than did laggards. This might be expected on the basis of the two-step flow hypothesis. Innovators could hardly depend on friends and neighbors for information about new farm practice,

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[18]Everett M. Rogers and George M. Beal, "The Importance of Personal Influence in Technological Change", Social Forces, 36: 329-335, 1958.

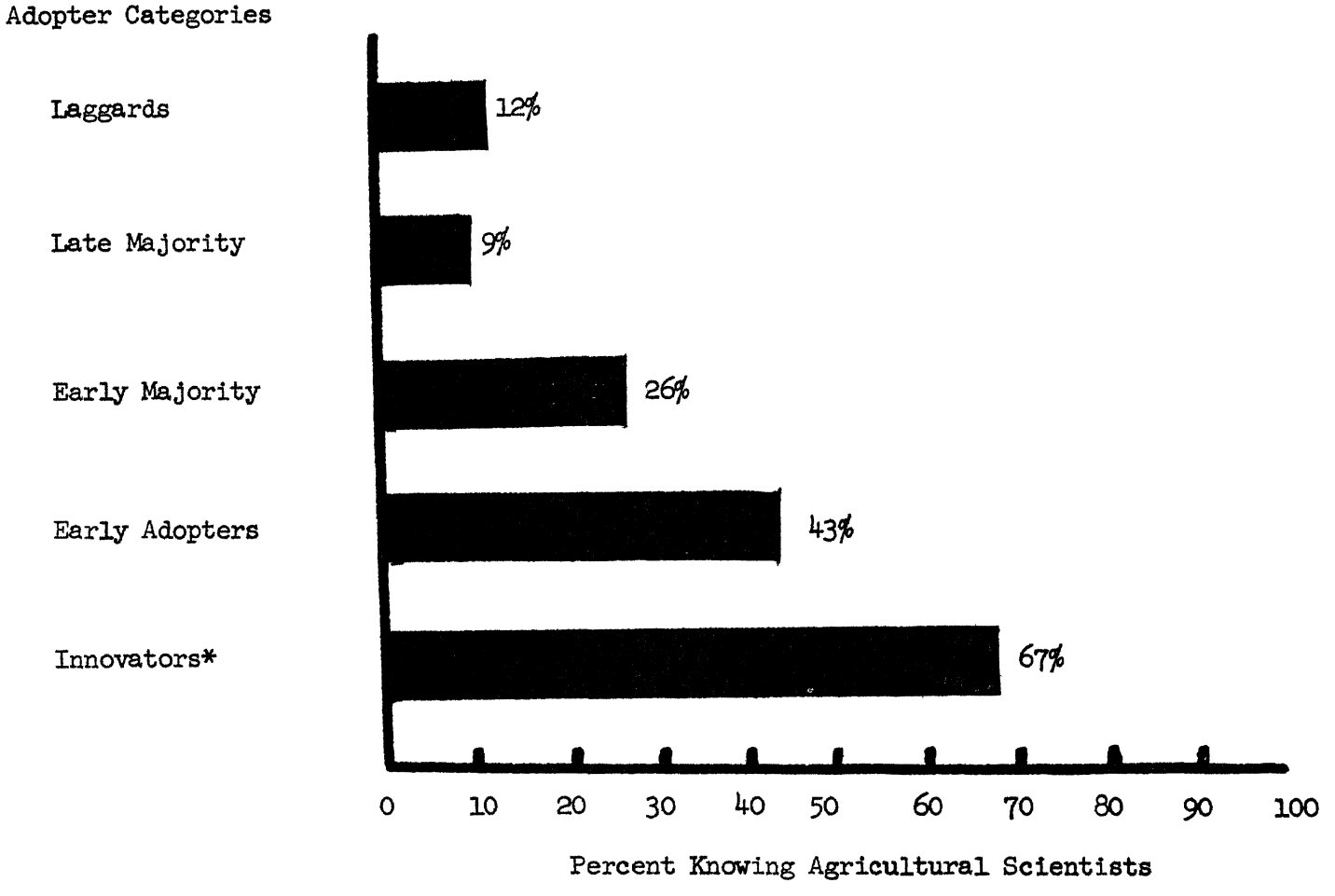

Figure 17. Percent Knowing Agricultural Scientists by Adopter Category

*Based on responses of only the three innovators in the commercial farmer sample.

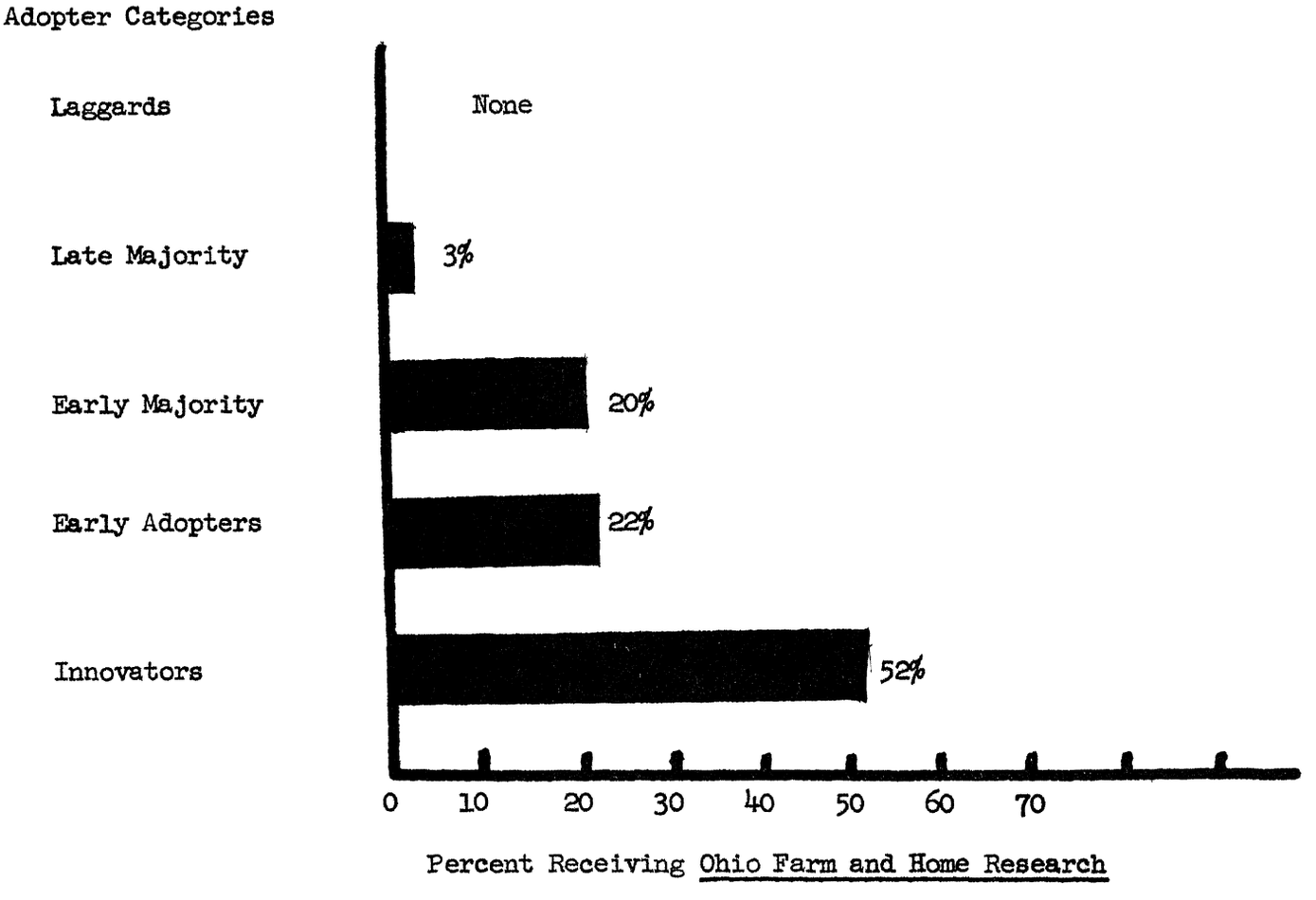

Figure 18. Percent Receiving Ohio Farm and Home Research by Adopter Category

because at the time of the innovators' adoption decisions none of their peers have any experience with the new idea. However, the laggards are surrounded by other farmers who have information and opinions about the new idea at the time the laggards adopt.

Farm Magazines

At the time the innovators and early adopters decide to adopt a new farm practice, one of their primary (available) sources of information is farm magazines. The main purpose of most farm magazines is to communicate information about new farm ideas. Past research findings on the two-step flow of communications would suggest that innovators and early adopters make relatively greater use of the mass media in general and farm magazines in particular.

Findings from the present study indicate that innovators subscribe to the greatest number of farm magazines and laggards to the fewest. Figure 19 shows the number of farm magazines received by adopter category. The relationship between Adoption-of-Farm-Practices Scores and the number of farm magazines read is significant at the five percent level.

Not only do innovators read more farm magazines, but they might be expected to read different magazines. However, analysis of the data showed that there were few differences as to specific farm magazines read on the basis of adopter category. One reason for this might be the wide circulation that each of the five major farm magazines received. The average Ohio commercial farmer subscribed to about three of the five major farm magazines.

County Extension Agent

Respondents were questioned as to their contact with their

county Extension agent during the year preceding the research interview. Information-seeking contacts with the county Extension agent could be of several types: attending meetings, reading newsletters or bulletins, calling the agent on the phone, or visiting with him on the respondent's farm. From this data, an Extension Contact Scale was developed which measured the amount of contact each respondent had with his county Extension agent.[19]

Past research findings have generally indicated that those farmers who are relatively early to adopt new practices have the greatest degree of contact with their county Extension agent. There is little previous evidence, however, as to whether innovators or early adopters have more Extension contact. There is a tendency for innovators to go directly to agricultural scientists for farm information, thus circumventing the county Extension agent.

Figure 20 indicates that early adopters have a greater degree of contact with their county Extension agent than do innovators or other adopter categories. The relationship between Extension Contact Scores and Adoption-of-Farm-Practices Scores is significant at the one percent level.

The total Extension Contact Scale was broken down into two sub-scales: the Extension Impersonal Contact Scale and the Extension Personal Contact Scale. The former included all impersonal types of Extension contact such as by reading bulletins, newsletters, or newspaper articles. The latter scale included all types of personal contact with the county Extension agent

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[19]A more detailed description of the Extension Contact Scale may be found in Rogers and Capener, op. cit.

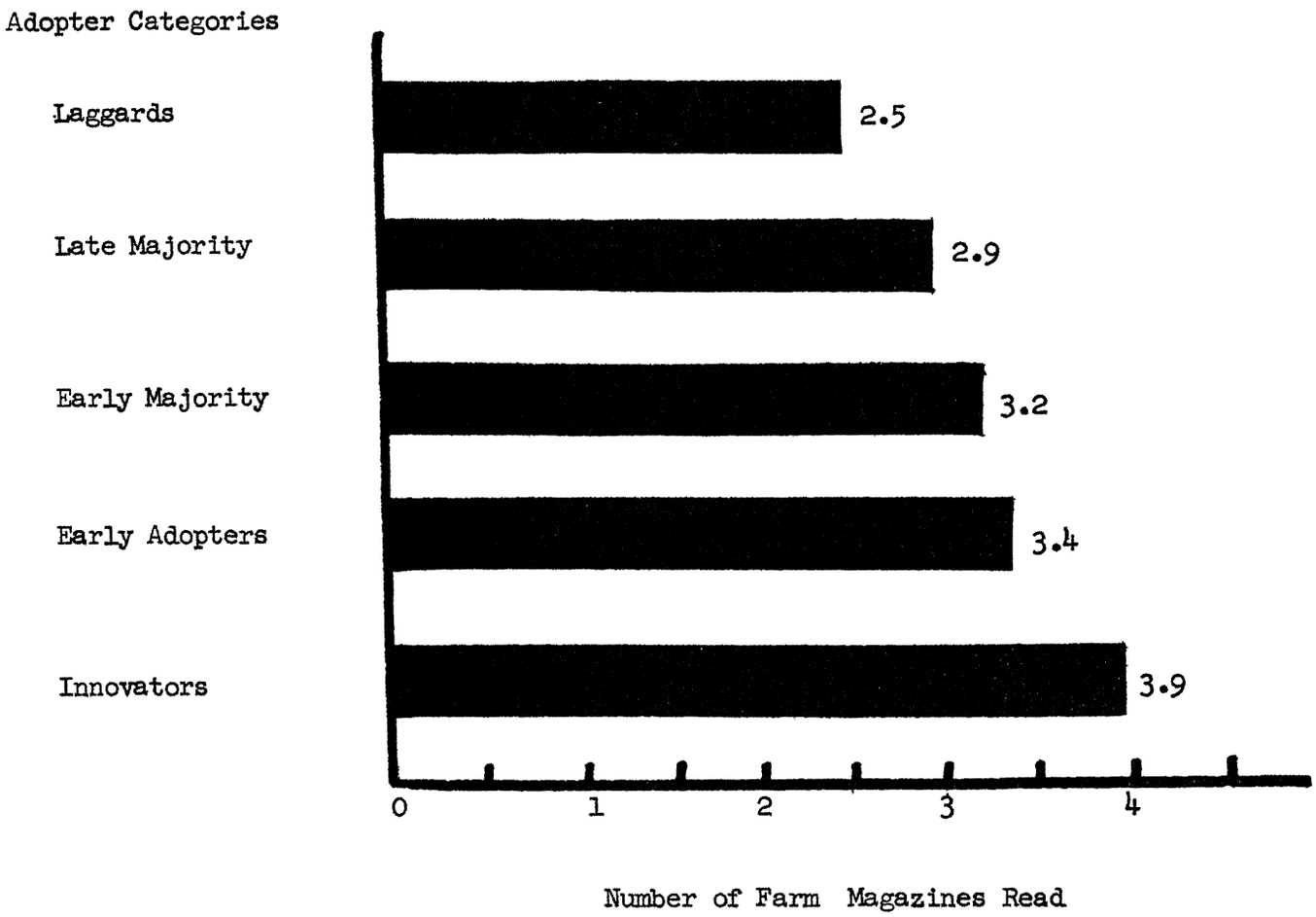

Figure 19. Number of Farm Magazines Read by Adopter Category

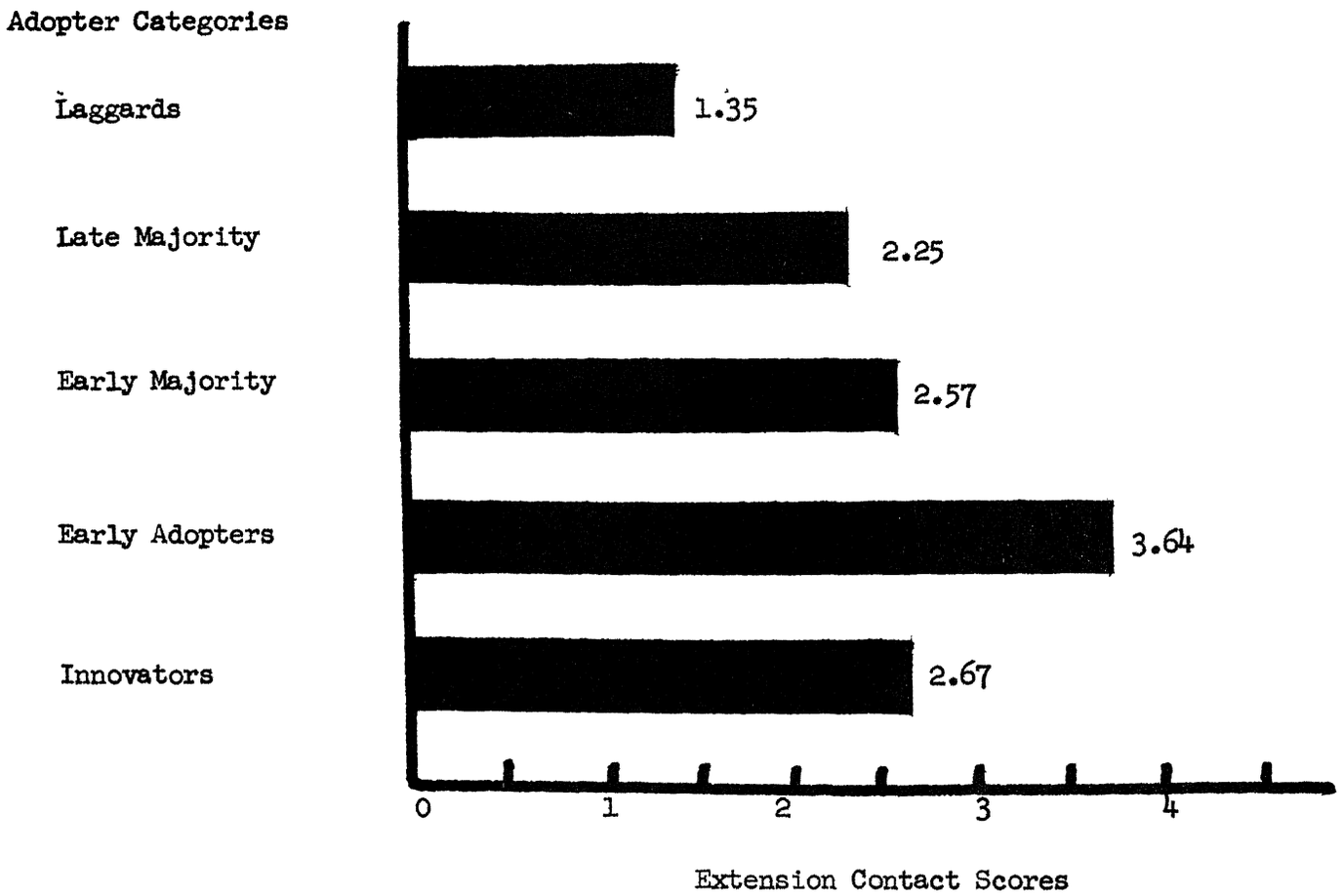

Figure 20. Extension Contact Scores by Adopter Category

such as at Extension meetings, office visits, or farm visitations.

A generally similar pattern of results was found for both sub-scales on the basis of adopter categories. Early adopters had a greater degree of both personal and impersonal contact with their county Extension agent than any other adopter category. Differences as to impersonal contact tended to be less sharp among the adopter categories. Reading of printed Extension mass media seemed to "get through" more equally to all adopter categories. This was less true of personal contacts, which were more sharply concentrated among the early adopters.

The 96 respondents in the innovator sample were asked, "How much help do you receive from your county agent about new farm practices?" Analysis of the replies indicates that the role of the county Extension agent may be different when he is interacting with innovators than with other adopter categories.

Some innovators perceived their county Extension agent as their most important and most reliable source of new farm information. This by no means was a majority of the innovators, however. Typical comments of these innovators were:

> "I would say I get more help from the county agent than anywhere else."
>
> "I receive a great deal of information; we have a fine county agent here."
>
> "He is our closest advisor. I receive bulletins and get information every month or so."

A greater number of innovators indicated they viewed their county Extension agent in a sort of "latent" role; he was available and could be called upon in case of need. But many of these farmers went on to mention that they actually make

relatively little use of their county Extension agent. The following comments perhaps illustrate this latent role of the county Extension agent as perceived by the innovators:

> "You can get help unlimited if you go after it, or if you make your wants known."
>
> "I receive all the help I ask for, but maybe I do not get to see him often enough."
>
> "I don't really get much help on his (county agent's) initiative, but he can always be depended upon if I go to him for advice."

Another type of response from some innovators placed on the county Extension agent in a "legitimizing" role; that is, although he was not always the source of new farm information, the county Extension agent often was important in placing the stamp of approval upon the new practice and thus convincing some innovators to adopt. The following comments illustrate this legitimizing role perceived by some innovators:

> "The farmer usually gets the new idea from some other source, and then talks it over with the agent to see if it is practical on his own farm."
>
> "Anytime there is doubt in my mind about a new practice, I consult our county agent."

Yet other replies seemed to indicate that some innovators tended to regard their county Extension agent as almost an "equal" in knowledge about new practices. The average years of education possessed by innovators (over 20 percent were college graduates) would suggest that in some respects they may correctly view themselves as equal in technical competence to their county Extension agent. The innovators were often highly specialized in their farm enterprises. Thus, they only needed to keep abreast of new developments in one area while county Extension agents were forced

to be "generalists." Several comments reflected this view of the agent in a "technically equal" role:

> "Commercial companies and farm magazines seem to get here first with the new ideas. The county agent isn't too much help to me."

> "The agent is of almost no help to me. I am a graduate of Ohio State University in Animal Science and I am more aware of current practices than he (the county Extension agent) is."

In summary on the roles of county Extension agents, many innovators viewed their agent in a latent or potential role; he was there to be called upon if needed. Some innovators regarded their agent as their best single source of new farm information. The innovators also viewed the county Extension agent as a legitimizer or someone whose opinion of new practices was important although he might not be a source of information about the practice. A few innovators regarded their agent as a technically competent equal (or even inferior).

Even though innovators have less contact with county Extension agents than do early adopters, they are more personally acquainted. This may be partly due to the differential role-perception of the innovator. He is more likely to view the agent as an equal and as someone he can feel free to call by the first name. The relationship between Adoption-of-Farm-Practices Scores and degree of acquaintance with the county Extension agent is significant at the one percent level.

Vocational Agriculture Teacher

Another change agent of importance to farmers as a source of new farm information is their vocational agriculture teacher. When the percentage of farmers having contact with their vocational agriculture teacher (within the year preceding the interviews)

was analyzed on the basis of adopter category, similar findings were encountered as in the case of contact with county Extension agents. The early adopters were most likely to have contact with their vocational agriculture teacher, the innovators were next, and the laggards had least contact (Figure 22). The relationship between Adoption-of-Farm-Practices Scores and Vocational Agriculture Contact Scores is significant at the one percent level.

In addition to this analysis, it was possible to determine the differential contact of adopter categories with their vocational agriculture teacher on the basis of personal and impersonal contact. As in the case of county Extension agent contact, personal contact included meetings and personal visits while impersonal contact included utilization of vocational agriculture mass media messages. In general, personal contacts were more frequent than were impersonal contacts. The average farmer had more than twice as many personal contacts with his vocational agriculture teacher as he had impersonal contacts. The opposite was almost true in the case of contact with county Extension agents where impersonal contact was much more frequent than personal contact. This finding suggests that vocational agriculture teachers operate on a more personal basis with their constituents when compared to county Extension agents, and are less dependent on such impersonal contacts as radio, bulletins, and newsletters. The personal contact with vocational agriculture teachers tended to be especially concentrated among the innovators and early adopters, while impersonal contacts with these teachers tended to be more evenly distributed across all of the adopter categories.

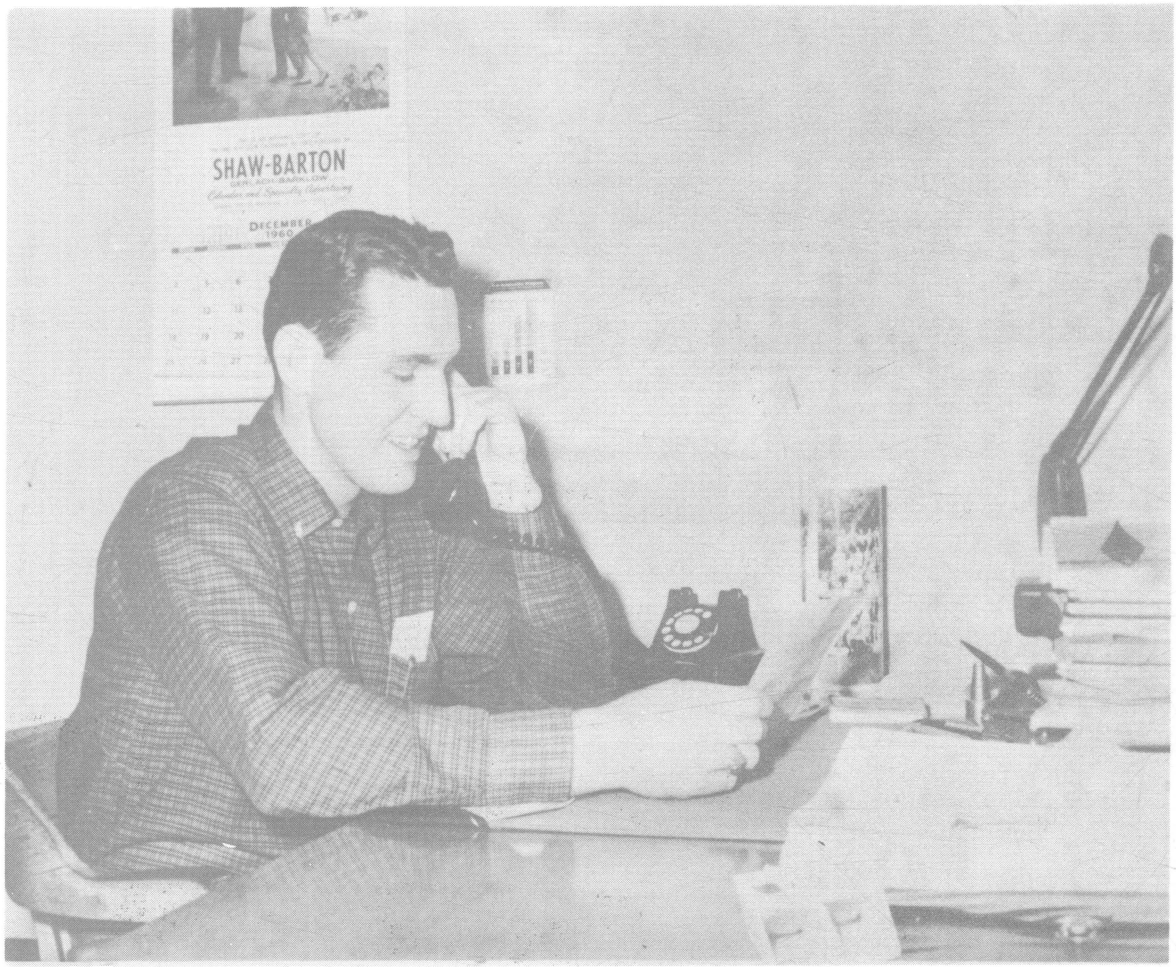

Figure 21. Early Adopters Have More Personal Contact with County Extension Agents Than Any Other Adopter Category. They make more telephone requests for information and attend more Extension meetings.

Innovators, however, are slightly better acquainted with County Extension Agents.

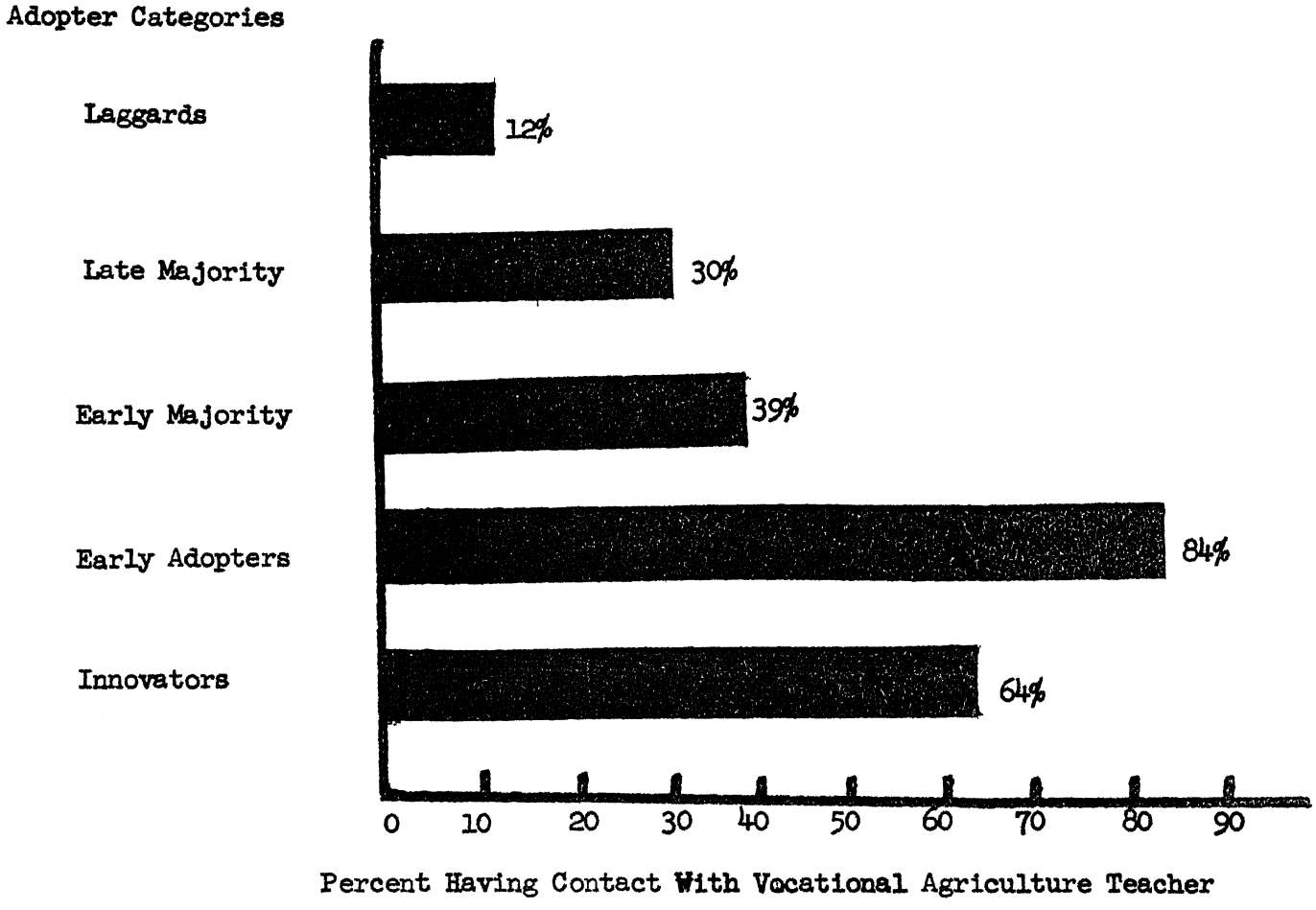

Figure 22. Percent Having Contact With Vocational Agriculture Teacher by Adopter Category.

ADOPTION BEHAVIOR

Obviously, a farmer cannot adopt a new farm practice until he is aware of it. In the "adoption process" by which an individual adopts a new idea, the awareness stage preceeds the adoption stage.

An Awareness-of-Farm-Practices Score was computed for each respondent. This scale credited a farmer with more points for becoming aware of a new practice at a relatively earlier date than the other farmers in the study. The awareness dates included in the Awareness-of-Farm-Practices Scale were for the same 25 practices included in the Adoption-of-Farm-Practices Scale. Farmers with higher Awareness Scores would tend to generally become aware of new practices at a relatively earlier date.

Innovators were aware of the 25 new farm practices relatively earlier than were the other adopter categories (Figure 23). The relationship between Adoption-of-Farm-Practices Scores and Awareness-of-Farm-Practices Scores is significant at the one percent level.

The Adoption Period

The adoption period is the length of time required for the adoption process to take place. The adoption period for a given practice is the period of time which an individual requires to pass through the adoption process, that is, from awareness to adoption.

Extension workers, agricultural missionaries, and other change agents wish to speed up the process by which new practices are adopted. One method is to more adequately communicate information about new ideas so as to create awareness at an earlier date. Another method is to shorten the amount of time required

for the adoption process after an individual is once aware of a new practice. In fact, there is little evidence that lack of knowledge about new practices actually delays their adoption.[20] Non-adopters are often aware of a new practice but are not motivated to try out and adopt the new practice. Ryan and Gross[21] reported that almost all of the Iowa farmers in their study heard about hybrid seed corn before more than a handful were planting it.

Respondents in the present study were asked (1) what year they first heard about, and (2) what year they first used 25 new farm practices. By subtracting the year of adoption (first used) from the year of awareness (first heard about), the length of the adoption period in years was computed for each of the 25 farm practices. The time measure of the adoption period is crude (only to the nearest year), but probably is sufficient for present purposes. The lengths of the adoption period for each of the 25 practices for each farmer were combined into an overall measure of the adoption period. Farmers who had a lengthy adoption period for one practice tended to have a relatively longer adoption period for other practices. "Adoption period scores" could range from zero to nine for each respondent.

Innovators have shorter average adoption periods than do laggards (Figure 24). Farmers who adopt relatively earlier have lower average adoption period scores (indicating a shorter average adoption period). The relationship between Adoption-of-Farm-Practices Scores and Adoption Period Scores is significant at the one percent level. These findings are consistent with those of other research

[20] Eugene A. Wilkening and Frank A. Santopolo, "The Diffusion of Improved Farm Practices from Unit Test-Demonstration Farms in the Tennessee Valley Counties of North Carolina", Raleigh, North Carolina Agricultural Experiment Station, Mimeo Report, 1952, P.31.

[21] Bryce Ryan and Neal C. Gross, "The Diffusion of Hybrid Seed Corn in Two Iowa Communities," Rural Sociology, 8:15-24, 1943.

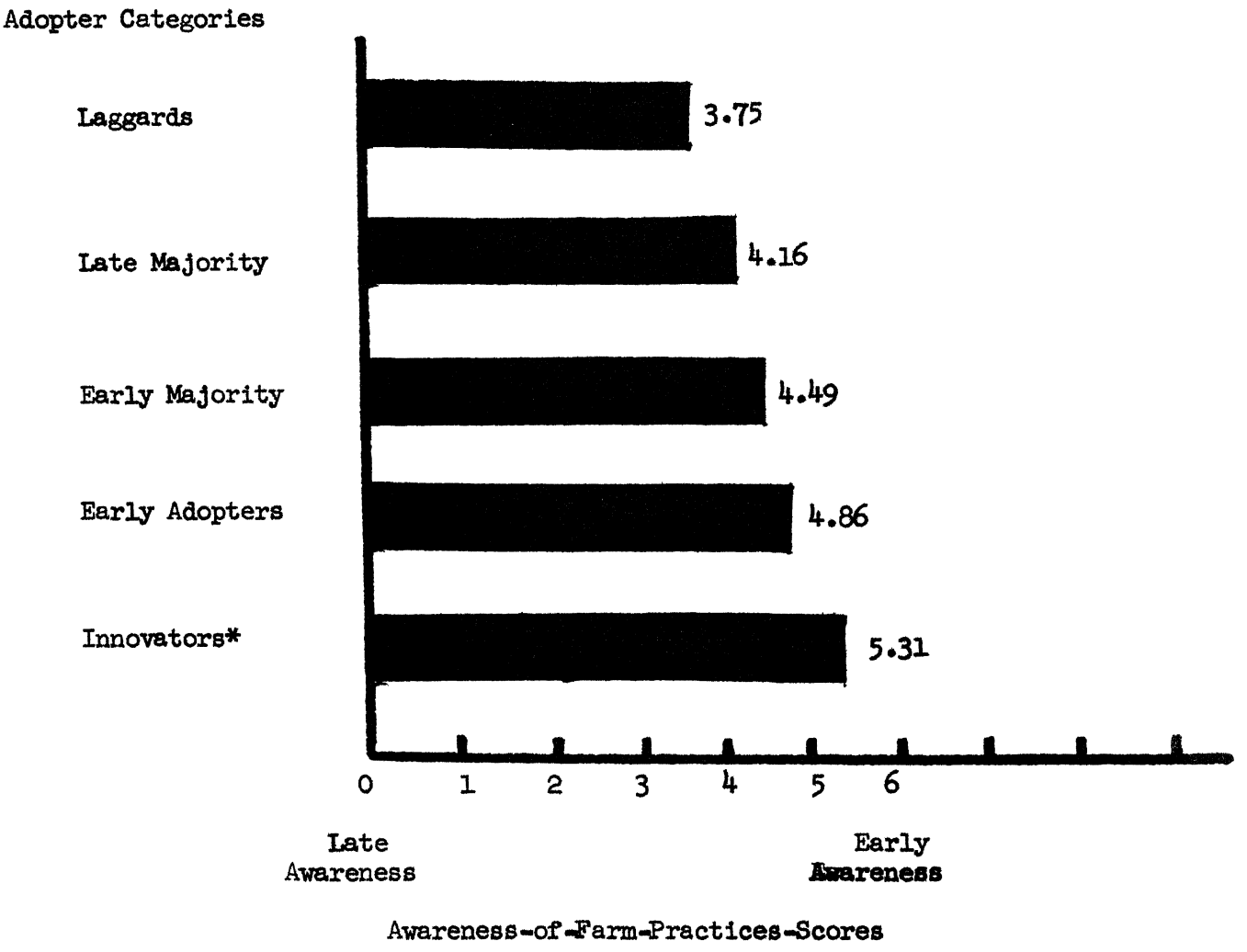

Figure 23. Awareness-of-Farm-Practices Scores by Adopter Category

*Based on responses of only the three innovators in the commercial farmer sample.

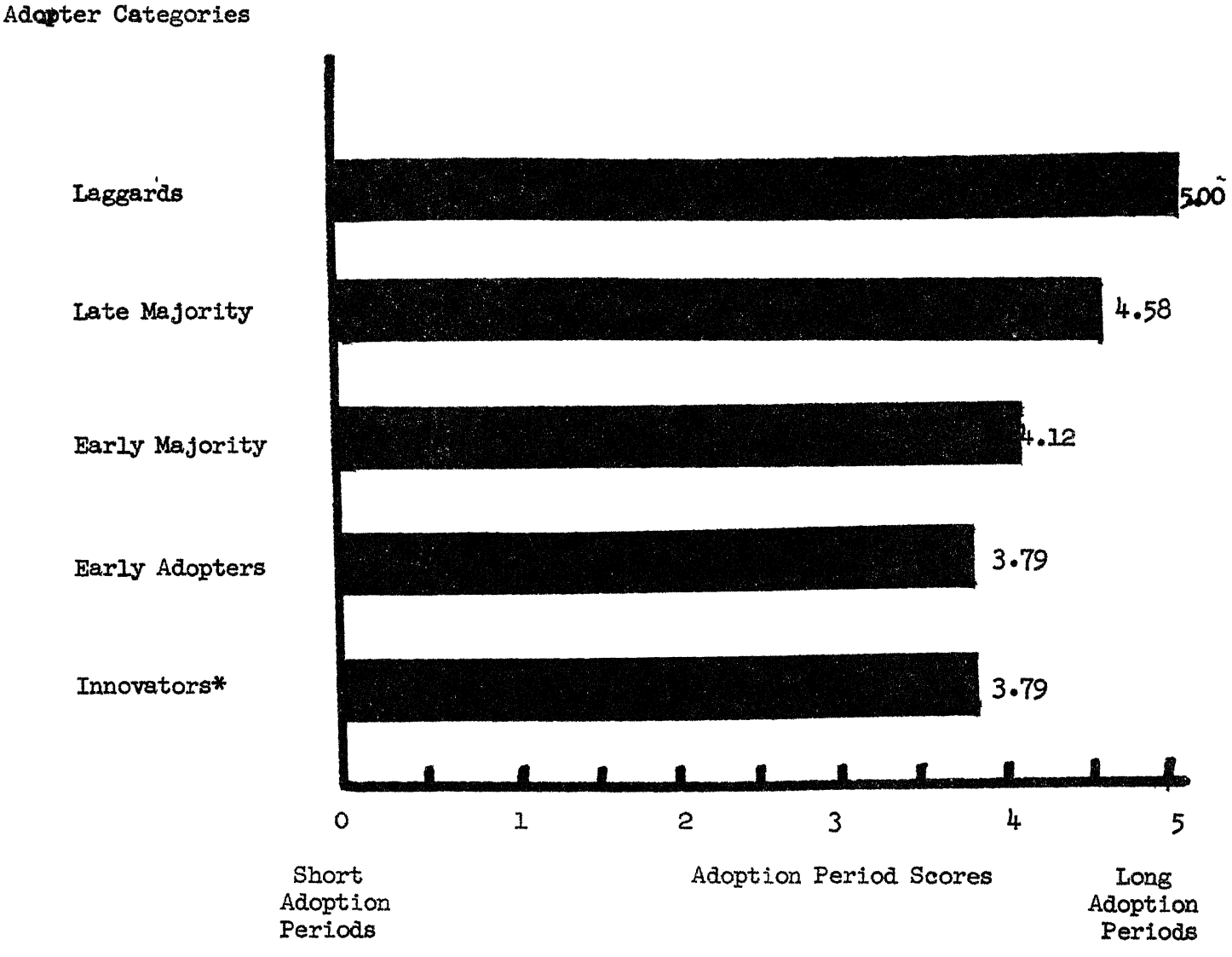

Figure 24. Adoption Period Scores by Adopter Category

*Based on responses of only the three innovators in the commercial farmer sample.

studies. For example, the average adoption period for Iowa innovators adopting 2,4-D weed spray was 0.4 years. Laggards required 4.6 years to pass from awareness to adoption of this practice.[22]

The findings indicate that the first farmers to adopt a new practice require a much shorter period of years to pass through the adoption period. The first farmers to adopt a new practice do so, not only because they become aware of the practice sooner than their neighbors, but because they require fewer years to move from awareness to adoption. Innovators perhaps gain part of their advantageous position (relative to other adopters) by learning about new practices at an earlier time, but the present findings suggest that the most important reason that innovators are the first to adopt is because they require a shorter adoption period.

Why do innovators require a shorter adoption period? Several reasons may be suggested. Innovators are more "research-minded" and possess a stronger "science-orientation". Thus, an innovator has more favorable attitudes toward new technology and less "behavioral inertia" must be overcome by communication stimuli. Innovators may have shorter adoption periods because they use more technically competent sources of information (often traveling directly to agricultural scientists) and because they place greater creditibility in these sources than does the average farmer. Innovators may also possess a type of mental ability that enables them to deal with abstractions. An innovator must be able to conceptualize relatively abstract information from mass media sources and apply this new information on his own farm. Later adopters can observe

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[22]Beal and Rogers, op. cit.

the results of new farm practices on other farms and may not require this ability to deal with abstractions. Rogers and Beal[23] found that innovators scored significantly higher on a five-point rating on ability to deal with abstractions.

ATTITUDES

The time gap between awareness of a new practice and actual adoption has been discussed in the previous section of this bulletin. Lack of information may be one important barrier to the rapid adoption of new farm ideas. But another important factor affecting the rate of adoption is a farmer's attitude. Some farmers enjoy trying out new ideas; others do not. Some individuals are willing to borrow money in order to purchase new products or equipment; other farmers say they would not borrow capital under any circumstances. These and other attitudes affect a farmer's adoption of new farm practices.

Venturesomeness

Venturesomeness is the degree to which individuals possess a favorable attitude toward trying new ideas and practices. It is obvious that some farmers are more venturesome than others and that this attitude is related to adoption of new ideas. Previous attempts to measure venturesome attitudes have met with several difficulties. One problem is that most respondents seem to feel it is socially acceptable to be venturesome and as a result, few are willing to admit that they are not venturesome. Some researchers

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[23] Op. cit., "Reference Group Influences," p. 73.

have asked farmers their opinions of new farm practices and constructed a venturesomeness index on the basis of this data.[24] A farmer's opinion of a new practice, however, is likely to be strongly influenced by his actual experience with the practice. Thus, a high relationship was "built in" to the measures of adoption and attitude.

In the present study, a venturesomeness scale was constructed in a similar manner to that used by Alfred Politz, Inc. in a study of homemakers.[25] The farmers were presented with descriptions of six hypothetical new farm practices, such as a new feed additive, a new cultivation technique, and a new farm machine. For each hypothetical practice, the respondents were rated as to whether they would "adopt immediately," "wait and see," or "not be interested." The venturesomeness scale credited individuals for a favorable attitude toward the six hypothetical new practices.

Innovators must necessarily be more venturesome than laggards. The innovators adopt a new practice soon after they first learn of its existence; the present findings indicate they have shorter adoption periods. Innovators did score higher on the Venturesomeness Scale than did the laggards (Figure 25). The relationship between Adoption-of-Farm-Practices Scores and Venturesomeness Scores is significant at the five percent level.

Localiteness

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[24] Examples of researchers who have used this type of venturesomeness measure are Frederick C. Fliegel, "A Multiple Correlation Analysis of Factors Associated with Adoption of Farm Practices", Rural Sociology, 11:284-292, 1956; and Eugene A. Wilkening, "Acceptance of Improved Farm Practices in Three Coastal Plain Countries," Raleigh, North Carolina Agricultural Experiment Station, Technical Bulletin 98, 1952.

[25] Better Homes and Gardens, A Twelve Month Study of Better Homes and Gardens Readers, Des Moines, Meridith Publishing Company, 1956.

Merton[26] categorized individuals as "cosmopolites" and "localities." The localites were persons who read local newspapers, had local friends, and participated in formal organizations in the local community. In comparison, cosmopolites had their friends, interests, and organizational memberships outside of the local community in which they lived.

Several later researchers have attempted to construct a scale to measure this localite-cosmopolite dimension.[27] Localiteness is defined as the degree to which an individual is integrated into the local neighborhood and community. Typical items in the Localiteness Scale were the degree to which work and equipment were exchanged with neighbors, amount of visiting with neighbors, and importance of neighbors' opinions on the respondents' farming decisions. A respondent who scored high on the Localiteness Scale would tend to value the local neighborhood and community as an important reference group. The locality-oriented individual would identify with the neighborhood. He would prefer the Gemeinschaft-like nature of this group rather than the Gessellschaft-like nature of the wider society.

One shortcoming of the present Localiteness Scale is that the items may measure the degree of informal social participation as well as the degree of locality orientation. For example, farmers who have a high frequency of visiting with neighbors display both

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[26]Robert K. Merton, Social Theory and Social Structure, Glencoe, Illinois, Free Press, 1957.

[27]Everett M. Rogers, "A Conceptual Variable Analysis of Technological Change", Unpublished Ph.D. thesis, Ames, Iowa State College, 1957, p. 108; Gregory P. Stone and William H. Form, "The Local Community Clothing Market," East Lansing, Michigan Agricultural Experiment Station Technical Bulletin 262, 1957; and William M. Dobriner, The Suburban Community, N.Y., G. P. Putnam's, 1958, pp. 132-143.

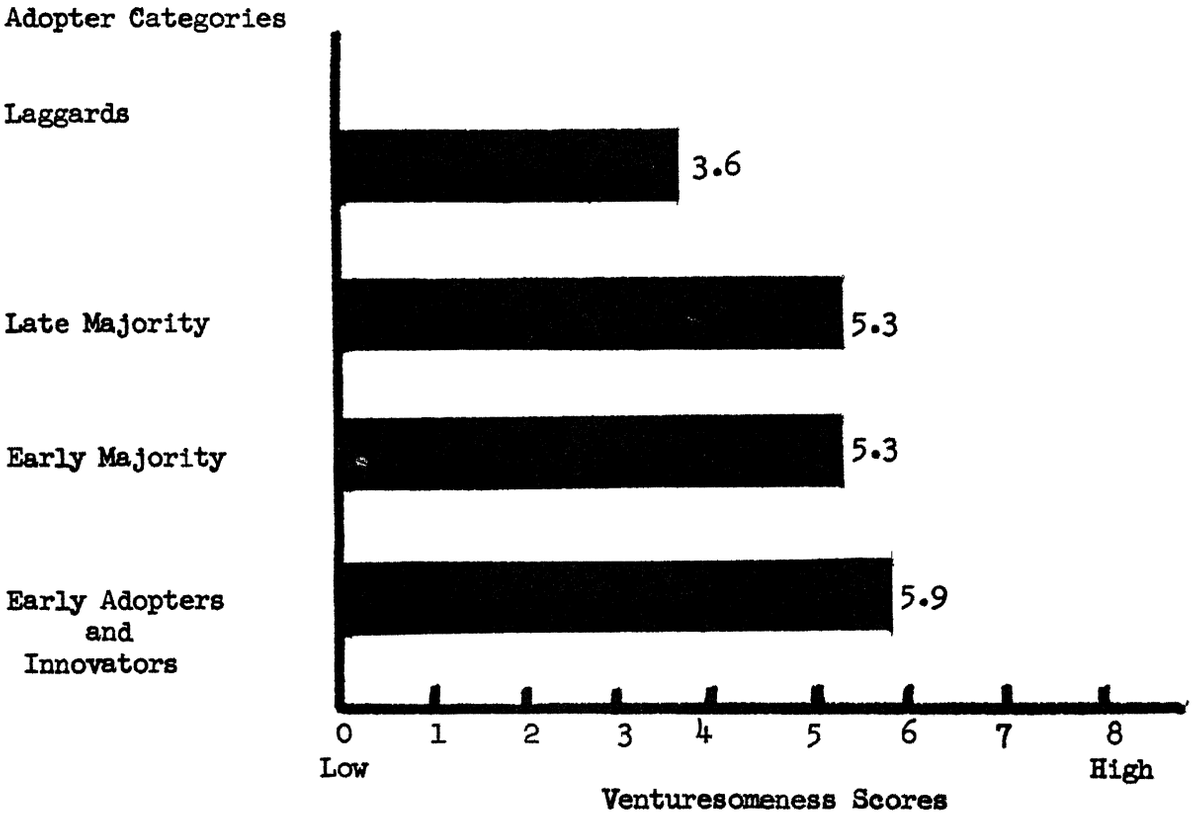

Figure 25. Venturesomeness Scores by Adopter Category

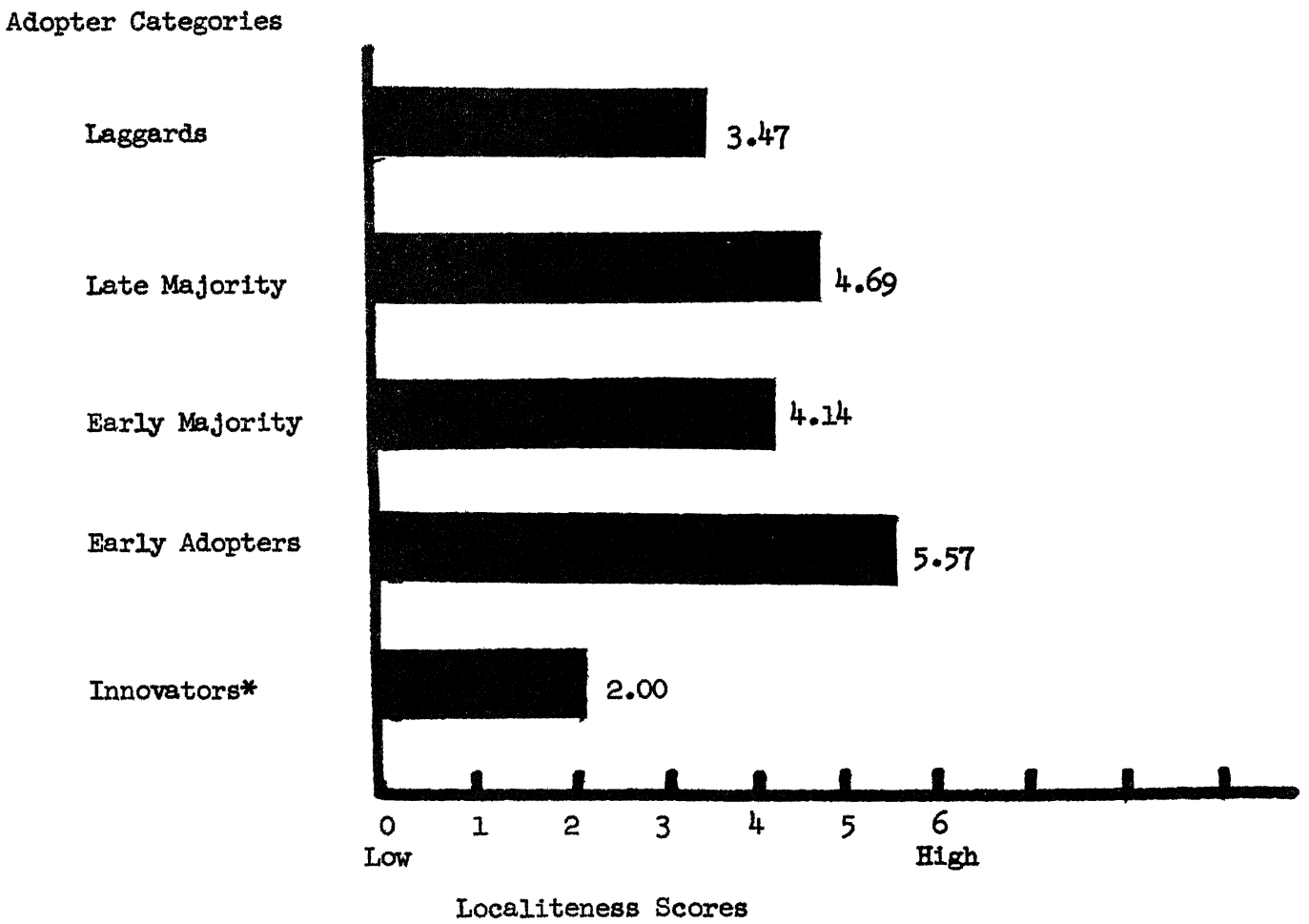

Figure 26. Localiteness Scores by Adopter Category

*Data from only the three innovators in the commercial farmer samples are included in this figure, however, the data from the other 96 respondents in the innovator sample (while not directly comparable) strongly support these findings.

locality orientation and informal social participation. One way to avoid this problem is to ask respondents whether they visit more with local or with non-local people, thus ignoring the degree of informal social participation.

The original two-step flow hypothesis implied that opinion leaders secured their information mainly from the mass media. Later analyses,[28] however, have suggested that these sources of information may be either personal or impersonal as long as they emanate from a technically competent source. In the present case information about new farm practices may be secured from mass media (farm magazines and bulletins) or by personal contact with scientists, change agents, or other farmers already adopting the practice. Most of these sources are located outside of the local community. Thus, we would expect the earlier adopting categories to have less localiteness. Innovators would be expected to travel widely to secure new farm information.

Innovators may be less localite because they are only partially integrated into the local neighborhood. An innovator is different from the average farmer; as such, he does not fit smoothly into the social relationships of the local neighborhood. The present findings indicate that innovators have less localiteness than any other adopter category (Figure 26). The early adopters have the greatest degree of localiteness. They are integrated most tightly into the local community and neighborhood; this is consistent with the earlier finding that early adopters have the highest degree of adoption leadership (and the most influence upon their neighbors' adoption decisions). The relationship between Adoption-of-Farm-

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[28] Elihu Katz, "The Two-Step Flow of Communication." An Up-To-Date Report on An Hypothesis", Public Opinion Quarterly, 21:61-78, 1957.

Practices Scores and Localiteness Scores, however, is not significant at the 5 percent level.

Responses of the 96 innovators indicated a wide perspective in terms of travel to learn about new farm practices. The respondents were asked, "Within the past year, have you traveled outside of your county to observe some new farm practice in operation?" Seventy-seven percent of the innovators said they had done so. And few of these innovators had traveled only to the next county! In fact, almost half of the respondents had not only traveled outside of their county but outside of their state or the United States to observe new farm practices. Some of the replies are as follows:

> "Beef and dairy enterprises in South America, wheat practices in Canada, and new beef ideas in Colorado and Nebraska."
>
> "I visited with swine research men at the Iowa and Minnesota (Agricultural Experiment) Stations."
>
> "I was interested in dairy and beef nutrition in Michigan and potato growing automation in Pennsylvania."
>
> "Saw and discussed broiler operations and cattle feeding operations in Indiana, Illinois, and Iowa as well as Ohio this year."

Innovators not only travel widely outside of the local area, but they are likely to receive a lack of respect from their neighbors for their innovators. The 96 respondents in the innovator sample were asked, "How do your neighbor-farmers feel about many of the new farm ideas that you use on your farm?"

More than half of the responses were in terms of lack of respect from neighbors. Typical responses illustrate this attitude:

> "Some think that we are a little cracked."
>
> "The way I operate my farm is not the way to win popularity contests among one's neighbors."
>
> "Sometimes they shake their heads."
>
> "Fifty percent think I am crazy, the other 50 percent are sure I am."

Many of the remaining comments followed the general theme, "My neighbors are skeptical at first but they are convinced when the new ideas turn out successfully." Comments which illustrate this attitude of innovators' neighbors are:

> "They (neighbors) think I spend too much for new practices, but now they're all doing the same."
>
> "Some talk contempt, but they watch with interest and many of them follow."
>
> "Some are doubtful at first, but when they see it (a new farm idea) pay out, they also try it."

Yet another theme running through a small minority of the replies was, "Neighbors respect my farming and are indebted to me for introducing new ideas."

> "I feel I have helped my neighbors more in the field of soil conservation--strip cropping and grassland farming. Also artificial insemination of dairy cattle."
>
> "They (neighbors) think I do a lot of experimental work. They follow in a year or so if the practice is good."

Why do farmers generally place a positive value upon progress and scientific farming developments, yet ridicule the innovators who introduce these new ideas? The answer may lie in the fact that farmers value new agricultural technology in general but must be convinced of the utility of each new farm practice that is developed.

The laggards have less localiteness than any other adopter category except the innovators (see Figure 26). Why are the laggards rejected from the neighborhood group? For different reasons than in the case of the innovators. The innovators travel widely and the local reference group is of little importance to them. The laggards seldom travel outside of the community, neither are they integrated into the local neighborhood. The reason may be the inferior social status of the laggard. He cannot exchange farm equipment with his

neighbors; he doesn't have the large power equipment to exchange. He can't discuss new practices with his neighbors on an equal basis; he retreats from the competitive aspects of an "over-the-back-40-fence" discussion with his neighbors because of the threat involved in his inferior position.[29] Another reason that laggards score low on the Localiteness Scale is because the Scale may measure the degree may measure the degree of informal social participation as well as locality orientation. The laggards have lower informal participation and this would be one reason for their lower locality orientation scores.

Belief in Agricultural Magic

Agricultural magic is defined as that complex of farming beliefs and practices which has developed from traditional sources and which lacks any firm scientific explanation. These beliefs tend to be accepted because they "work" rather than because they have any basis in scientific fact or principle.

Examples of agricultural magic are planting crops, castrating or dehorning livestock, or cutting weeds by the "signs of the moon." Some farmers believe that if corn is planted in the zodiacal sign of the Twins, two ears will grow on each stalk. Root crops such as potatoes, onions, and beets should be planted when the point of the moon is down. Grains and other non-root crops such as corn, tomatoes, and beans should be planted when the horns of the moon point up or in the "light" of the moon.

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[29]Similar evidence of the insecurity of the laggard in these farmer "bull sessions" is reported by Rogers and Beal, "Reference Group Influences," op. cit.

Figure 27. Innovators Travel Widely to Secure Information From Agricultural Scientists at Tours and Demonstrations

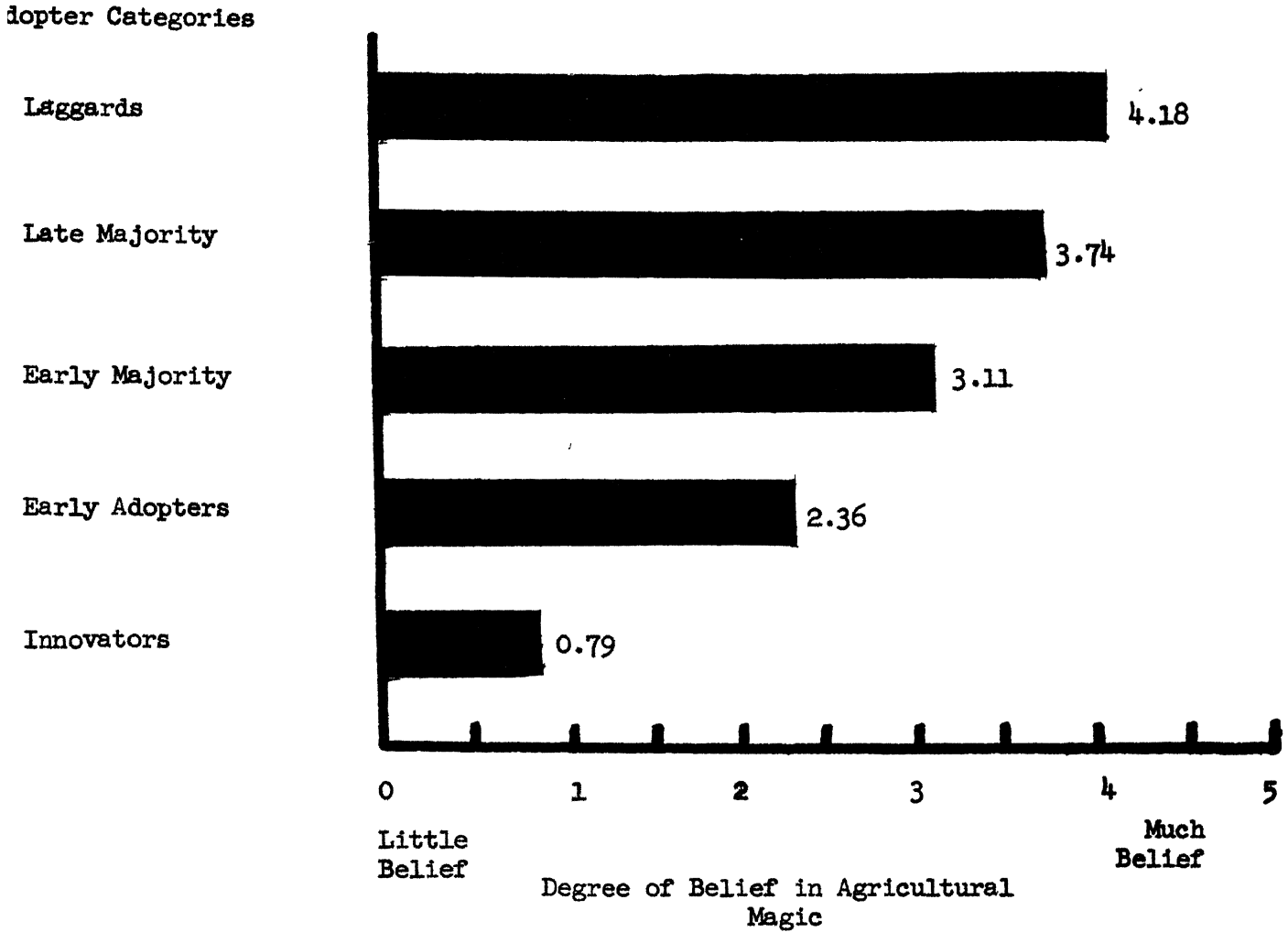

Figure 28. Degree of Belief in Agricultural Magic by Adopter Category

Agricultural magic is also involved in the practice of witching for wells and other sources of water. Water-witching entails the use of a Y-shaped branch to locate underground water supplies. The forked branch is grasped so that it points upward while the water-witch walks back and forth over the area. The dowsing rod twists and the apex points downward at the point where an underground "water vein" is located. The water-witch then instructs well drillers to sink their shaft at that point.

One would expect that belief in agricultural magic would tend to be shattered as farmers accept more rational and scientific ideologies. There is some evidence that this is true. However, there is still considerable reliance on agricultural magic among modern highly-commercialized farmers. For instance, 35 percent of the commercial farmers included in the present study responded that there are some things about farming where signs of the moon are important. Forty percent agreed that when a farmer wishes to drill a well he should first witch for water. Only 18 percent strongly disagreed with both of these two magical beliefs.

The rather widespread support for agricultural magic is all the more amazing when one considers that it lacks any scientific basis. There is considerable evidence, for example, that water-witching is not an empirically reliable method for locating underground supplies of water.[30] The percentage of dry wells is just as high or higher for those that have been witched as not witched. Nevertheless, Hyman and Cohen[31]

[30] Evon Z. Vogt, "Water-Witching: An Interpretation of a Ritual Pattern in a Rural American Community," Scientific Monthly, 75: 175-186, 1952; and O. E. Meinzer, "U.S. Ground Water Geologist Warns Against Water Diviners," Waterworks Engineering, 97: 571, 1944.

[31] Ray Hyman and Elizabeth G. Cohen, "Water-Witching in the United States," American Sociological Review, 22: 719-724, 1957.

estimated the number of water-witches in the U. S. in 1957 at 25,000.

An Agricultural Magic Scale was administered to both the farm operators and their wives in the field interviews. Two items were selected which seemed to receive almost universal awareness throughout the state. These items were:

1. There are some things about farming where signs of the moon are important.

2. When a farmer wants to drill a well he should first witch for water.

Respondents were asked their opinion of these two statements and their responses were coded on a four-point scale from "agree quite a bit" to "disagree quite a bit." The items were combined into a crude index called the Agricultural Magic Scale.[32]

Farmers who tend to cling to more traditional magic beliefs would be expected to be slower to accept new farm practices. Figure 28 indicates that innovators placed much less faith in agricultural magic than did laggards. The relationship between Adoption-of-Farm-Practices Scores and Agricultural Magic Scores is significant at the 1 percent level.

Innovators generally tended to debunk magical beliefs. Only 9 percent of the state-wide sample of innovators believed in signs of the moon and only 4 percent believed in water-witching. As one innovator remarked:

> "I think the big farmer can't afford to wait for the moon, as he has too much at stake to have it rain before the proper (by the moon) time (for planting). But I know of a small farmer who follows this practice and he does very well. I'm not a moon man, you might say."

On the contrary, laggards generally depended more heavily upon magical beliefs. As one laggard related:

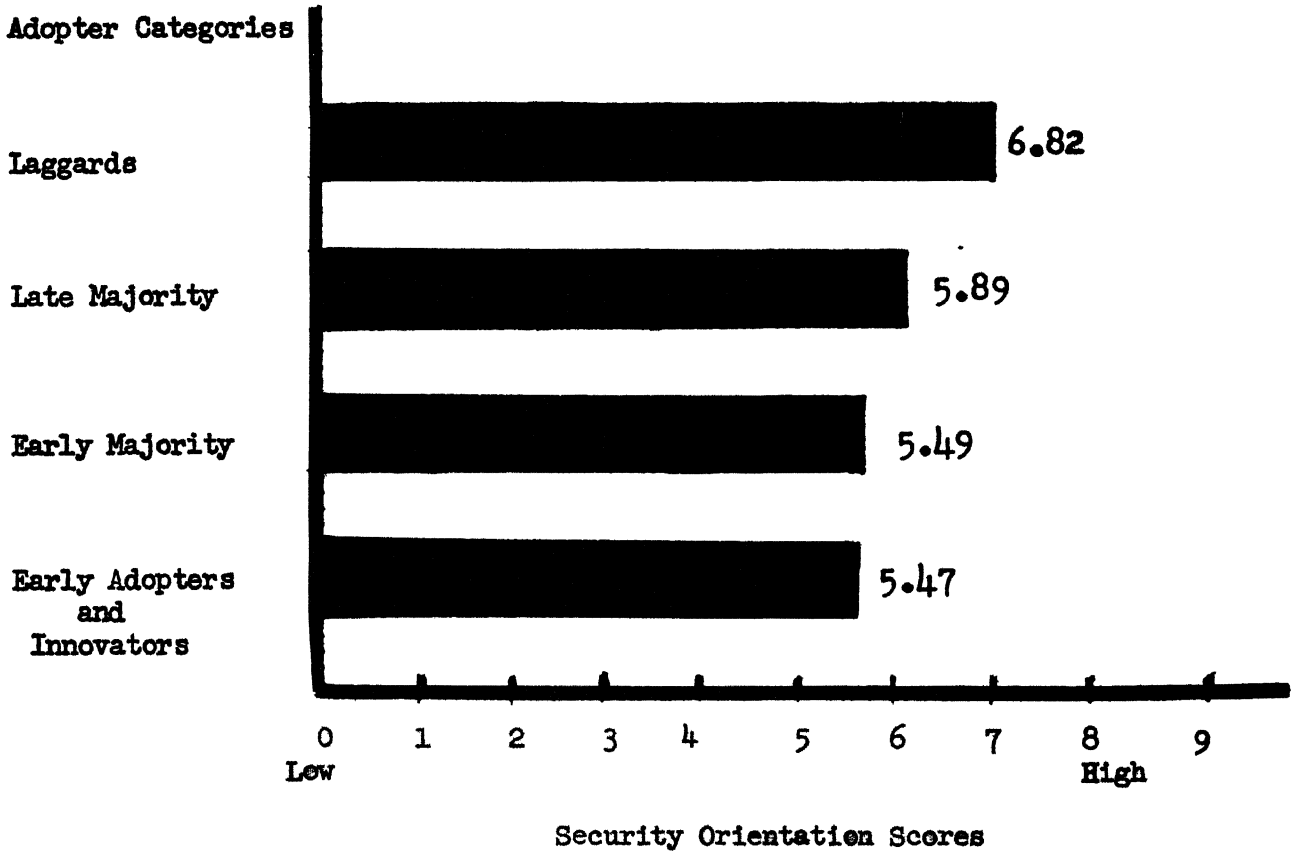

Figure 29. Security Orientation Scores by Adopter Category

"I know that water-witching works. A neighbor does it all the time. I've seen him do it. It's hard to explain why it works but some people just have that power."

Security Orientation

The adoption of some new farm practices such as bulk milk tanks, sprinkler irrigation systems, and new farm equipment require the investment of considerable capital. Thus, we would expect a reluctance to borrow capital to be negatively associated with the adoption of new practices.

Some farmers are more highly "security-oriented" than others. They are more reluctant to borrow money and they would rather pay off mortgages than purchase new products or equipment. A Security Orientatic Scale was constructed to measure this dimension. The three items in this Scale are:

1. Attitude toward credit.
2. Choice between paying off a mortgage or investing in additional milk cows (in a hypothetical decision-making situation).
3. Choice between paying off a mortgage or investing in commercial fertilizer (in a hypothetical decision-making situation).

Innovators were less security-oriented than were laggards (Figure 29). They were more willing to borrow capital and less likely to settle mortgages with their farm income than to invest this income in adopting new practices. The relationship between Adoption-of-Farm-Practices Scores and Security Orientation Scores is significant at the 5 percent level.

The single item in the Scale, attitude toward borrowing money, was very closely (negatively) related to adoption scores. This suggests that many laggards have a strong mental block to borrowing money under any circumstances. This attitude may be one facet of a

human dimension termed "rationality" by some rural sociologists.[33] They found that high rationality (as measured by a rationality scale they constructed) was one characteristic of innovators.

SELF-IMAGES OF ADOPTER CATEGORIES

An objective method of categorizing farmers into adopter categories was described and illustrated in an earlier section of this bulletin. For some purposes, however, a more subjective rating as to adopter category may be valuable. If a farmer views himself as an innovator (that is, he "thinks he's an innovator"), then he will act as if he were an innovator. This suggests that if a change agent could convince a farmer that he is an innovator, then the farmer would adopt new practices as if he were an innovator. Little is actually known about how to change self-images, but it is probably difficult to do so.

Self-Ratings

Hess and Miller[34] found that the self-images of Pennsylvania dairymen were not completely accurate. There was a tendency to rate oneself as a "better farmer" than objective measures indicated.

In the present study, the respondents were asked, "About where would you rate yourself in respect to adopting new farm practices?"

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[33]Alfred Dean, Herbert A. Aurbach, and C. Paul Marsh, "Some Factors Related to Rationality in Decision Making Among Farm Operators," Rural Sociology, 23: 121-135, 1958.

[34]C. V. Hess and J. F. Miller, "Some Personal, Economic and Sociological Factors Influencing Dairymen's Actions and Success," State College, Pennsylvania Agricultural Experiment Station Bulletin 577, 1954.

1. Among the first in the neighborhood.

2. A little faster than most of the neighbors.

3. About average.

4. A little slower than most of the neighbors.

5. Among the last in the neighborhood.

Most of the respondents indicated little embarrassment in answering this question in the personal interviews. All but 1 of the 96 farmers in the innovator sample answered the item on a mailed questionnaire. The five categories above roughly corresponded to the five adopter categories.

The self-images of the five adopter categories are shown in Table 1. There was a general tendency for the self-images to be accurate The coefficient of agreement "A" between adopter adopteries and self-images is .792.[35]

Two types of biases are apparent in Table 1. One biasing tendency is for the earlier adopting categories to underrate their adopter category. For example, 48 percent of the innovators perceived themselves as early adopters, early majority, or late majority. On the other hand, about 15 percent of the non-innovators in the sample thought that they were innovators ("among the first in their neighborhood to adopt new practices").[36] The other type of bias in the self-images was the tendency of the later adopting categories to over-rate their adopter category.

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[35]W. S. Robinson, "The Statistical Measurement of Agreement," American Sociological Review, 22: 17-25, 1957.

[36]Everett M. Rogers, "A Note on Innovators," Journal of Farm Economics, 41: 132-134, 1959.

Table 1. Self-Rating as to Adopter Category by Objective Adopter Category

Self-Rating as to Adopter Category	Objective Adopter Category				
	Innovators	Early Adopters	Early Majority	Late Majority	Laggards
Innovators	52	7	3	3	2
Early Adopters	35	1	6	7	1
Early Majority	10	6	20	19	6
Late Majority	1	0	5	5	4
Laggards	0	0	1	1	4
Total	98*	14	35	35	17

*One innovator did not respond to this question.

The self-images of the innovators and early adopters were more accurate than those of the laggards. Only about one-fourth of the laggards perceived themselves as "among the last in the neighborhood to adopt new practices." The underrating of the innovators and early adopters may be due to modesty; the overrating of the laggards due to a feeling that it is not socially acceptable to be among the last to adopt new ideas.

Nevertheless, the present findings do indicate that there is a good deal of accuracy in farmers' self-images as to adopter categories. Almost 30 percent of the commercial farmer sample rated themselves in the same adopter category as that indicated on the basis of more objective criteria (as explained in Appendix A). Another 46 percent rated

[36]Everett M. Rogers, "A Note on Innovators," Journal of Farm Economics, 41: 132-134, 1959.

themselves in an adopter category adjacent to that determined on an objective basis. Thus, only 24 percent of the commercial farm sample had widely inaccurate self-images as to adopter category.

Adopter Category Aspirations

After the respondents indicated the adopter category in which they felt they belonged, they were next asked the adopter category in which they thought they would belong in ten years. It was then possible to measure the discrepancy between the respondents' present self-ratings (as to adopter category) and the respondent's "future" self-ratings (ten years hence). This was a rough indication of the adoption aspirations of the respondents; it was a comparison of present self-images with those of the future.

Almost two-thirds of the respondents in the commercial farmer sample thought they would remain in the same adopter category. If they were an early adopter, they felt they would still be an early adopter ten years in the future. Of the 37 respondents who felt they would be in a different adopter category in ten years, the majority felt they would slip to a later category. Twenty-eight of the 37 felt they would "drop behind" at least one adopter category. Many different reasons were given for this tendency to "fall behind," but the two most common were: (1) advancing age and gradual retirement from farming; and (2) a feeling that "farming is just changing too fast these days for me to keep up." There was a sense of apathy and futility in many of these latter responses, reflecting a sense of "losing out" in the competitive agricultural economy.

On the basis of adopter category, the respondents most likely to feel they would fall behind into a later adopter category in ten year were the early and late majority (Table 2). The laggards were more

likely than any other adopter category to aspire to a higher adopter category. This was only 18 percent of the laggards category; most laggards were apathetic about moving into another adopter category. A detailed analysis of the 18 percent of the laggards who aspired to earlier adopter categories disclosed that they were typically beginning farmers who were presently late in adopting new practices due to a lack of capital. They felt that as they accumulated additional capital in the next ten years, they would move up to different adopter categories.

The innovators tended to feel they would remain innovators in the future. This was also true of the early adopters to a lesser degree. Of course, the innovators had no earlier adopting category they could "move up" to. Thus, their aspirations were somewhat limited by their present situation.

Table 2. Adoption Aspirations by Self-Rating as to Adopter Category

Self-Rating as to Adopter Category	Adopter Category Aspirations in Ten Years			
	Earlier	Same As Present	Later	Total
Innovators*	---	100%	---	100%
Early Adopters	---	86%	14%	100%
Early Majority	6%	63%	31%	100%
Late Majority	9%	60%	31%	100%
Laggards	18%	70%	12%**	100%

*Based on responses of only the three innovators in the commercial farmer sample.

**It is possible for 12 percent of the laggards to feel they would be in a later adopter category in 10 years (even though there is no later adopter category), because these respondents (erroneously) perceived themselves to be late majority who would become laggards in 10 years.

Wife's Adopter Rating of Husband

The wives of the respondents in the commercial farmer sample were asked to which adopter category they felt their husbands belonged (i.e., "among the first in the neighborhood," etc.). There was a general tendency for the farm housewife to rate her husband in an earlier adopting category than that to which the husband belonged on objective criteria. About 59 percent of the wives placed their husband in an earlier adopting category; this was particularly characteristic of the wives of early majority and innovators. About 11 percent of the wives could not rate their husbands as to adopter category.

The wives' ratings were less accurate than the farmers' self-images. The wives were much more likely to overrate their husbands and much less likely to underrate them.

THE ROLES OF THE INNOVATOR

Agricultural innovators appear to perform important functions in the diffusion of new farm ideas from scientists to farmers. Innovators do not seem to play any one single role in this diffusion process. Rather, they seem to play at least four major roles in varying degrees. These four roles of the innovator are:

1. A line of communication
2. A local demonstrator
3. An influencer of local change agents
4. A developer of new technology

The agricultural innovator acts as a <u>line of communication</u> between agricultural scientists and local farmers. Innovators have much more extensive and more direct contacts with both governmental and commercial scientists than do their later adopting neighbors.

In this sense, the innovator acts as a line of communication by personally conveying the news of recent research findings. The presence of innovators probably helps to speed up the diffusion process.

An innovator certainly helps to make a new practice conspicuous. Innovators help to create awareness of new practices on the part of the average farmer. However, innovators do not seem to add credibility to the acceptance of new practices. They create awareness; they seldom convince.

An innovator undoubtedly, however, adds some local credibility to research findings by demonstrating them on his own farm. In many cases, innovators carefully try out a new practice so that its results may be compared with existing techniques. For example, one innovator applied a new weed spray in strips across one field, alternating these strips with a previous weed spray. A state-wide sample of Ohio farmers using irrigation (an innovator) in 1958 reported that an average of 4.5 other persons had visited their farm within the past year to observe their irrigation system.[37]

Even though innovators may function as local demonstrators, this does not necessarily lead directly to the adoption of the new practices by other farmers in the area. In fact, these other farmers often regard the innovator's farming methods with disrespect. Nevertheless, the innovator does demonstrate the use of the new farm practice, and by doing so, increases his neighbors' awareness of the practice even though not directly convincing them to adopt it.

Innovators also influence local change agents regarding new farm practices. There is evidence that agricultural innovators are

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[37]Rogers and Pitzer, op. cit.

often aware of new farm practices before the local Extension Service or other government agency workers. These local "change agents" often report that their interest in a new farm practice is sparked by a discussion with an innovator among their constituency. Innovators call new practices to the attention of these change agents and may request additional information about them. As a result, the change agent may be motivated to carry out an educational program about the new practice among his constituents. For example, 9 percent of the county Extension agents in Ohio named "key farmers" as their most important source of information about new farm practices.[38]

The innovator role as a developer of technology is complementary to the more sophisticated efforts of government and commercial scientists. The farmer-innovator further refines, modifies, and perfects new farm ideas after their original development by others. Several Ohio innovators owned their own welders and reported that they often "improved upon" the standard farm equipment and machinery that they purchased. Few innovators were actually inventors, but many reported efforts to "help work the bugs out of some new practice" before it was ready for general adoption.

For example, one innovator had lost thousands of dollars in developing a hog nursery system. Since perfecting the type of nursery system that he desired, this innovator indicated that about 30 out-of-county visitors toured his facility annually. This example illustrates two roles of the innovator: as a developer of new technology and as a local demonstrator.

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[38]Rogers and Yost, op. cit.

IMPLICATIONS FOR FUTURE RESEARCH

The Two-Step Flow Hypothesis

The two-step flow of communication was a guiding hypothesis behind the present study. This hypothesis is now re-examined in terms of the present evidence.

The two-step flow of communication suggested that new ideas are first communicated to and adopted by the innovators and early adopters who, in turn, convince the later adopters to use the new ideas. Evidence from the present study (and from other data gathered under this research project) indicates that there <u>is</u> a "relay function" in the diffusion of agricultural technology. This relay function from agricultural scientists to farm people, however, may be performed by innovators and early adopters, county Extension agents, commercial dealers, or others.

The present findings do not clearly indicate whether the innovators or the early adopters are more important as adoption leaders (that is, in performing the relay function of influencing their neighbors). This may well be a topic for future research efforts. However, the present results do indicate there is some rationale for separating the innovators from the early adopter category. These two categories were found to differ on many personal and social characteristics, although it was often simply a matter of degree.

Group Relationship of Innovators

Some insights into the group relationships of innovators are available from the present study. Innovators belonged to far more formal organizations than any other adopter category. The innovators not only belonged to <u>more</u> groups, they also belonged to

different groups than the average farmer. The innovator's group contacts are likely to be spread out over a much wider geographical area. The innovator's neighbors have little respect for his farming methods, but the innovator's friends (who share his enthusiasm for new ideas) may be spread out over a wide area. The innovator has "reference groups" just as does the average farmer; his reference groups, however, are different.

In a recent study of Ohio irrigators[39] it was found that while many of the innovators' immediate neighbors considered the adoption of irrigation with a strong negative attitude, the irrigators were members of friendship cliques with other irrigators. Thus, the innovators had group support in their adoption decisions. These irrigator-friends were often located over several counties.

This finding suggests that perhaps there is a "super-innovator" who influences the innovators to adopt a new practice. Super-innovators are "innovators among innovators." If super-innovators exist, a next research step would be to locate and study these individuals. Tentative evidence in the present study does suggest that super-innovators exist, but that one or more super-innovators may be found in each state for each new practice. Thus, one innovator may function as a super-innovator for one new practice, but a different person acts as a super-innovator for another new practice.

Unsuccessful Innovators

The findings in the present study are based largely on data secured from successful innovators. Because of the relatively high

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[39]Roger and Pitzer, op. cit.

risks involved in innovative behavior, there may well be "unsuccessful innovators." These individuals may be difficult to locate as they may bankrupt themselves out of farming. Nevertheless, future research might well proceed in the direction of studying these unsuccessful innovators.

Most of the farm practices included in the present Adoption-of-Farm-Practices Scale are Extension-recommended ideas. There occasionally appear on the farm market some new products that are not recommended and that are sometimes not successful. Would innovators also be the first to adopt these "unsuccessful practices" as well as the recommended practices? The answer to this question might provide valuable insights into the nature of innovative behavior.

Tentative Hypotheses

The purpose of this section is to suggest hypotheses for testing in future research studies. Few innovator characteristics included in this section are well validated by empirical findings; rather they are developed from intuitive insights gleaned from the research interviews and questionnaire returns from the innovators.

Agricultural innovators seem to possess a strong <u>science-orientation</u>. This is indicated by the 97 percent response to the mailed questionnaire by the innovator sample. Almost all of the respondents indicated that they wanted a copy of the present research report when it was available. Innovators seemed to realize the practical importance of agricultural research work. For example, one innovator remarked:

> "We're not running an experimental farm here. We don't weigh our cattle and figure the results from feeding this stilbestrol (a cattle-fattening sex hormone). We take it for granted that these experiments that have been run by our various colleges and feed companies are correct. At least, that's the way I figure it out."

This remark also indicates a degree of credibility or faith in the findings and recommendations of agricultural scientists. While innovators regard research findings with interest and respect, the average farmer is more likely to view them with doubt or indifference. In fact, several innovators indicated they felt research workers were too conservative in their recommendations and some were scornful of scientists for delaying the announcement of their results until they were fully confident of their findings.

Several of the innovators exploited the commercial aspects of the new farm products they had adopted. Many innovators were farmer-dealers in petroleum products, seed, livestock feed, agricultural chemicals, fertilizer, or other products. Typically, these innovators were the first farmers in their locality to adopt some new product; they then became convinced of its importance and utility and "cashed in" on their experience by marketing the new product to other farmers. In any event, many innovators were not only farmers; they were also "agribusinessmen."

There has been considerable speculation among anthropologists and other social scientists on the personality of the innovator. Barnett[40] has hypothesized that "there is a positive correlation between individualism and innovative potential." In another writing, this author[41]

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[40] Homer G. Barnett, Innovation, the Basis of Cultural Change, N.Y., McGraw-Hill, 1953, p. 65.

[41] Homer G. Barnett, "Personal Conflicts and Culture Change," Social Forces, 20: 160-171, 1941.

stated, "The disgruntled, the maladjusted, the frustrated, or the incompetent are pre-eminently the acceptors of culture innovations and change." Adams[42] found that while Barnett's hypothesis may perhaps hold true in cases where change is rapid and violent, the innovator has high prestige where change is gradual.

The tentative findings of the present study suggest that agricultural innovators are not maladjusted, frustrated, or incompetent. In fact, the composite picture of the innovator is an elite farmer who is highly research-oriented, commercialized, specialized, and successful. Perhaps this is due to the fact that a general theme of change and new technology seems to permeate modern agriculture. The innovator is the symbol of technological change; he is the first to adopt new farming practices.

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[42] Richard N. Adams, "Personnel in Culture Change: A Test of a Hypothesis," Social Forces, 30: 185-189, 1951.

APPENDIX A

CLASSIFICATION INTO ADOPTER CATEGORIES

A major dimension of analysis throughout this report is on the basis of adopter categories. The purpose of this appendix is to describe how the respondents were categorized as innovators, early adopters, early majority, late majority, and laggards.

The Adoption-of-Farm-Practices Scale

The Adoption-of-Farm-Practices Scale was used as a basis for classifying the farmers into adopter categories. This Scale consisted of 25 new farm practices in such varied farm enterprises as: weed control, crop production, sheep, swine, poultry, beef, and dairy. These practices were selected in consultation with Ohio Agricultural Extension Service specialists in each of these subject-matter fields. For instance, the Extension dairy specialists aided in the selection of the four dairy practices in the Adoption Scale.

An attempt was made to select practices for inclusion in the Scale that were: (1) adopted within the past ten years; (2) applicable to a wide range of farm sizes and farm conditions; and (3) recommended to most farmers by the Extension Service. The Adoption Scale was then pre-tested with about fifteen farmers residing in various locations of the state. Some practices were discarded after this pre-test because: (1) only a very small percentage of the farmers had adopted them; or (2) they had been adopted for more than ten years and farmers could not recall their date of adoption.

Educational psychologists advised the author that farmers could probably recall adoption dates for about ten years. The experience of the field interviewers generally supported this expectation. However, on several occasions sensitive probing was required to secure adoption

dates. For example, one farmer reported that he adopted 2,4-D spray "about five or ten years ago." The interviewer asked him if he had applied the weed spray with a sprayer mounted on his present tractor. "No," he replied, "I used 2,4-D when I had my old tractor yet, because I had to change the sprayer mountings when I purchased my new tractor in 1952. I first tried 2,4-D spray in 1950." By connecting adoption dates with other well-remembered events, such as when a son went to college, most respondents were able to provide fairly good data as to date of adoption of the 25 new practices.

The 25 farm practices included in the Adoption-of-Farm-Practices Scale were:

1. Band seeding of grasses and legumes.
2. Spraying with 2,4-D spray for weed control.
3. Spraying for spittle bug control.
4. Spraying Canada thistles with amino triazole.
5. Planting Ranger or Buffalo alfalfa varieties.
6. Planting Clintland oats variety.
7. Testing soil for fertilizer and lime needs.
8. Using Decon or Warfarin for rat control.
9. Using phenothiazine for internal parasite control of sheep.
10. Clipping or shearing rams in breeding season.
11. Feeding antibiotics to hogs.
12. Using lindane or benzene hexachloride for hog mange or lice.
13. Using piperazine compounds for hog worm control.
14. Raising Christmas trees.
15. Vaccinating poultry for bronchitus.
16. Vaccinating poultry for Newcastle disease.

17. Using mechanical poultry waterer.

18. Raising hybrid chicks.

19. Feeding stilbestrol to beef cattle.

20. Using phenothiazine for internal parasite control of beef cattle.

21. Treating beef or dairy cattle with a systemic insecticide for cattle grubs.

22. Using artifical breeding.

23. Using a pipeline milking system.

24. Using a bulk milk tank.

25. Using bulk application of fertilizer.

It was necessary to utilize a scoring system that would give equal weighting to each of the 25 practices included in the Adoption-of-Farm-Practices Scale. There was little reason to believe that any greater weight should be applied to any one practice in the Scale. The method by which equal weighting was applied to each practice was essentially on the basis of "standard scores." A standard score is computed by subtracting the mean ($\bar{X}$) from an observation (X_i) and dividing by the standard deviation ($\sigma_{\bar{X}}$) of the distribution. Where U_i represents a standard score, the formula may be expressed as:

$$U_i = \frac{X_i - \bar{X}}{\sigma_X}$$

A standard score is a "relative" type of score which, in effect, expresses the individual's position in relation to other members of a distribution. For example, an individual's year of adoption of a new practice when expressed in standard score form would indicate the individual's relative position in the distribution

of adoption dates (of the other farmers in the study).

For example, Farmer A adopted 2,4-D weed spray in 1948. The mean year of adoption is 1949 and the standard deviation of the adoption dates for 2,4-D weed spray is two years. The standard adoption score for Farmer A is 1948 minus 1949 divided by 2 which equals -0.5.

An advantage of standard scores is that the measuring unit is "pure," or free from the original unit of measure. For example, the time of adoption of a farm practice, such as hybird seed corn, may be mathematically compared with a widely different practice, such as commercial fertilizer. This advantage is important when constructing a composite adoption score composed of many practices. It is possible to add, subtract, or place weightings on each adoption item when it is expressed in standard form, even though the interval of time in which the adoption of each practice took place may vary.[43]

Categorizing Adopters

Past research findings[44] indicate that the adoption of a new practice over time will either be normally distributed or else closely approach normality. Likewise, the distribution of Adoption-of-Farm-Practices Scores was found to be normal.[45]

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[43] A description of sten scores, a type of standard scores used in the present study, may be found in Charles H. Coates and Alvin L. Bertrand, "A Simplified Methodology for Developing Multi-Measure Indices as Research Tools," Rural Sociology, 20: 132-141, 1955.

[44] These past research findings are summarized by Everett M. Rogers in "Categorizing the Adopters of Agricultural Practices," Rural Sociology, 23: 345-354, 1958.

[45] The Smirnov goodness of fit test was utilized to test the hypothesis that the Adoption Scores are normally distributed. The maximum deviation from normality is 12.84 which is less than the 13.34 allowable deviation at the five percent level of significance. There is not sufficient evidence to indicate that the distribution of the 104 adoption scores is not normal.

The normal shape of this distribution was utilized as a means of categorizing the respondents into five adopter categories. The normal distribution has two parameters, the mean ($\bar{X}$) and the standard deviation ($o_{\bar{X}}$), which may be used to divide the distribution into five areas. These five areas under the normal curve are labeled as: innovators, early adopters, early majority, late majority, and laggards. These categories and the approximate percentage of the adopters that are included in each category are located on a normal frequency distribution in Figure 30. The Adoption Scores had a mean of 4.32 and a standard deviation of 0.59.

The area lying to the left of the mean year of adoption plus two standard deviations ($\bar{x} \neq 2\ o_{\bar{X}}$) would include the first 2.5 percent of the farmers to adopt a new practice (innovators) with Adoption Scores above 5.50. The next 13.5 percent of the adopters would be included between $x \neq o_{\bar{X}}$ (4.91) and $x \neq 2\ o_{\bar{X}}$ and are labeled "early adopters." At the mean year of adoption plus one standard deviation ($x \neq o_{\bar{X}}$), a point of inflection occurs.[46] At this point, adoption ceases to increase at an increasing rate and begins to increase at a decreasing rate (and level off). Between this inflection point and the mean year of adoption, 34 percent of the adopters are included in the "early majority" category.

Between the mean and the other inflection point (at $x - o_{\bar{X}}$ where adoption begins to decrease at a decreasing rate) are included 34 percent of the adopters labeled as "late majority." The last 16 percent of the farmers to adopt a new practice (to the right of the inflection point at $x - o_{\bar{X}}$) are labeled as "laggards."

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[46] R. L. Anderson and T. Z. Bancroft, Statistical Theory in Research, N. Y. McGraw-Hill, 1952, p. 25.

Actually, a minor modification of this system of categorization was made. Because of the relatively small sample size (N = 104), the exact percentage of adopters desired in each adopter category could not be attained. In order to correct for this slight skewness, the actual adopter categorization was effected by means of the percentile method. This method assured that 2.5 percent of the respondents would be found in the innovator category because the 2.5 percent with the highest Adoption Scores were included. This resulted in Adoption Score limits for the adopter categories which were slightly different than those illustrated in Figure 30. The Adoption Score limits actually used are shown in Table 3.

A generally similar method of adopter categorization has been utilized in two other studies in Iowa.[47] It should be kept in mind throughout this publication that the main purpose of adopter categorization is for easier conceptualization on the part of lay audiences. Most of the figures and tables in this publication utilize the five adopter categories. However, for the purpose of testing relationships among variables, the Adoption-of-Farm-Practices Scores (rather than the five adopter categories) are utilized. If the adopter categories rather than the Adoption Scores were used in the testing of hypotheses, an overestimate of the tests of significance (reported in Appendix B) would result.

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[47] Rogers and Beal, "Reference Group Influences," op. cit.; and George M. Beal and Everett M. Rogers, "Research Methodology in the Adoption of Farm Practices," Ames, Iowa Agricultural Experiment Station Research Bulletin, in progress.

Table 3. Adopter Categorization by the Percentile Method

Adopter Category	Number of Respondents	Desired Percentage of Adopters Included in Category	Percentile Limits of Category
Innovators	3	2.5	0 to 2.5
Early Adopters	14	13.5	2.5 to 16
Early Majority	35	34.0	16 to 50
Late Majority	35	34.0	50 to 84
Laggards	17	16.0	84 to 100
Totals	104	100.0	

APPENDIX B

TESTS OF SIGNIFICANCE

The relationships between the Adoption-of-Farm-Practices Scores and each of the adopter characteristics were tested for statistical significance. For example, a coefficient of correlation of $\neq .321$ between Adoption Leadership Scores and Adoption-of-Farm-Practices Scores is significant at the 1 percent level. This means that there is a 99 percent probability that a relationship exists between Adoption Leadership Scores and Adoption-of-Farm-Practices Scores. Likewise, a correlation of less than .195 (when N= 104) is not significant. This relationship is not greater than could be due to chance sampling effects.

The relationship between Adoption-of-Farm-Practices Scores and each of the following variables are presented in the same order as they appear in the body of the publication. The relationship between the Adoption-of-Farm-Practices Scores and each of the following factors is indicated as follows:

1. Correlation with Adoption Leadership Scores is $\neq .321$ which is significant at the 1 percent level.

2. Correlation with number of farm practices respondent convinced friends and neighbors to adopt is $\neq .378$ which is significant at the 1 percent level.

3. Correlation with years of formal education is $\neq .523$ which is significant at the 1 percent level.

4. Correlation with formal participation scores is $\neq .321$ which is significant at the 1 percent level.

5. Correlation with interviewers' social class ratings is $\neq .486$ which is significant at the 1 percent level.

6. Correlation with age is - .316 which is significant

at the 1 percent level.

7. Correlation with cloze scores is ρ .320 which is not significant at the 5 percent level.

8. Correlation with interviewers' ratings as to interview rapport is ρ .393 which is significant at the 1 percent level.

9. Chi square on the basis of rental status is 8.49 which is not significant at the 5 percent level.

10. Correlation with size of farm in acres is ρ .264 which is significant at the 1 percent level.

11. Correlation with size of farm in PMWU's is ρ .456 which is significant at the 1 percent level.

12. Correlation with gross farm income is ρ .529 which is significant at the 1 percent level.

13. Correlation with gross farm income per man day labor is ρ .418 which is significant at the 1 percent level.

14. Correlation with farm labor efficiency is ρ .307 which is significant at the 1 percent level.

15. Correlation with index of specialization is ρ .424 which is significant at the 1 percent level.

16. Correlation with "psychological distance from the scientist" ratings is ρ .094 which is not significant at the 5 percent level.

17. Correlation with favorableness of attitude toward agricultural scientists is ρ .130 which is not significant at the 5 percent level.

18. Chi square on the basis of direct contact with agricultural scientists is 29.57 which is significant at the 1 percent level.

19. Correlation with degree of acquaintance with agricultural scientists is $+$ .353 which is significant at the 1 percent level.

20. Chi square on the basis of readership of Ohio Farm and Home Research is 39.42 which is significant at the 1 percent level.

21. Correlation with the number of farm magazines is $+$ .206 which is significant at the 5 percent level.

22. Chi square on the basis of farm magazine most helpful is 3.42 which is not significant at the 5 percent level.

23. Correlation with Extension Contact Scores is $+$ .336 which is significant at the 1 percent level.

24. Correlation with Extension Acquaintance Scores is $+$ .333 which is significant at the 1 percent level.

25. Correlation with VoAg Contact Scores is $+$ .262 which is significant at the 1 percent level.

26. Correlation with Awareness-of-Farm-Practices Scores is $+$ .514 which is significant at the 1 percent level.

27. Correlation with Adoption Period Scores is - .500 which is significant at the 1 percent level.

28. Correlation with Venturesomeness Scores is $+$ .206 which is significant at the 5 percent level.

29. Correlation with Localiteness Scores is $+$ .034 which is not significant at the 5 percent level.

30. Correlation with Agricultural Magic Scores is - .316 which is significant at the 1 percent level.

31. Correlation with Security Orientation Scores is - .241 which is significant at the 5 percent level.